TELEPHONE ENGINEER

VOLUME 27 MAY, 1923 Number 5

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Cable Maintenance Methods

Good Maintenance of Cable Plant Requires Frequent Inspection, Accurate Location and Prompt Clearing of Trouble. Here Is an Article That Tells How It Is Done

By M. T. CASTER
Plant Superintendent, Lincoln Tel. and Tel. Co.

In 1878, shortly after the first word was transmitted by telephone, Professor Alexander Graham Bell expressed the idea that cables of telephone wires could be laid underground or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufacturers, etc., uniting them through the main cable with a central office where the wire could be connected as desired, establishing direct communication between any two places in the city.

During the development of the telephone industry the use of telephone cable has rapidly increased until at present the amount invested in telephone cables represents approximately one-fourth the investment in distributing plant. Therefore maintaining this part of the telephone plant warrants very careful attention, and the application of the best means for reducing the expense and the service interruptions which result from cable troubles.

Cable trouble merits Sherman's definition of war, and, like war, prevention is better than cure.

Continuity of Sheath Is Highly Important

Because the conductors in the cable are generally insulated with paper, the insulating quality of which depends upon the absence of moisture, the importance of continuity of the sheath surrounding the cable is obvious.

The covering around the conductors in the earliest types of cables used consisted of layers of tape, which, when exposed out of doors, required frequent paints to protect it from the elements. It was early apparent that a metal covering with some flexibility would be necessary in order to properly protect the conductors and make telephone cables practical.

Lead was selected for use in covering cables because of its resistance to corrosive damage, its flexibility, and price, compared with other metals. However, pure lead readily crystallizes when subjected to vibration or frequent bending, and is ductile to a high degree. It has been found that the addition of a small percentage of tin or antimony produces an alloy which resists these phenomena and insures a reasonable length of life for cable sheath.

However, the best obtainable cable sheath is susceptible to crystallization and other damage due to vibration, bending and pressure, and it is therefore necessary that cable be properly supported so as to reduce vibration and bending to a minimum, and to exclude so far as possible any constant pressure upon the sheath in a concentrated area.

Most Trouble Can Be Prevented

Approximately 90 percent of cable trouble can be foreseen and prevented. Visual inspections of the entire cable system above ground and in manholes should be made at regular periods in order to detect bad conditions and apply remedies which will avoid trouble later on. In general an inspection of cable in manholes, if made every two years, will be sufficient. Inspection of aerial cable should be made at least twice each year.

Inspection of Underground Cable

There are certain locations and conditions where faults are most likely to develop. In manholes these points are where the cable enters the duct, and where cable supports should be in the manhole. The lack of proper supports will result in cracked sheath near the end of splices.

Inspection of Aerial Cable

In the inspection of aerial cable the inspector should examine the cable along the entire length of each riser not protected by molding or pipe; examine closely the sheath at the top of the riser pipe or at the end of the molding; inspect carefully at the edge of all cleats and supports; and examine the sheath in the bend where the riser cable leaves the pole and joins the cable on the messenger, giving careful attention to the cable supports near the pole and the condition of the sheath under and between these supports. He should also note carefully whether or not the cable is properly anchored and supported at corners and splices.

The inspection of cable in spans can generally be made from the ground, but on riser poles should be made by climbing the pole and examining the cable critically. The sheath should be be examined closely at each pole throughout the length of the cable; also at each end of all splices within reaching distance of poles. The branch cable at terminals should receive very careful attention to determine whether or not it is properly secured to the main cable and the messenger, at the end of the splice; also properly attached to the pole so as not to rest on crossarm braces, or other pole hardware; also that it is not being used by anyone in climbing the pole.

Inspection in Trees

Cable should be inspected closely where it passes through trees or where there is a possibility of limbs rubbing or coming in contact with the cable during high winds. Cable and messenger should be placed below rather than above limbs so that if a contact cannot be avoided, it will be between the messenger and the limb, rather than between the cable and the limb. Cable can frequently be shifted upon poles so as to avoid injury in trees.

Testing for Electrolysis

Underground cable sheaths should also be tested to determine whether or

not electric current, of appreciable quantity, is passing between the cable sheath and the earth or other object. Cable sheath is seriously affected by electrolytic action, which generally results when electric current of considerable volume flows from the cable sheath to the earth or other body through a poor contact. Electrolysis can best be avoided by establishing proper bonds between the cable sheath and ground or return conductors to power houses.

Chemical Damage

Cable sheath is also affected seriously by chemical action, therefore the presence of any of the acids or alkalies which affect lead should be avoided.

Locating Cable Trouble

When it is suspected that the insulation on the conductors in the cable has been damaged by mechanical injury or the entrance of moisture, a telephone receiver and dry battery are at once the most readily available, and the best preliminary testing instruments. When electric current is continually passed through a receiver no noise is heard in the receiver, but when the current is varied or interrupted the change is readily detected by a click which is heard in the receiver. In cable testing the presence or absence of this click, and also its magnitude, indicate to the experienced testman the relative condition of any circuit under test.

Receiver Test Magneto Exchanges

The following arrangement is best for use in magneto exchanges:

A wire should be connected from one pole of the receiver to ground and another piece of wire attached to the other pole of the receiver. This last wire can be used as a feeler for testing the conductors at the end of the cable to determine roughly which conductors are in trouble. It will readily be noticed that when contact is first made and broken with a good idle conductor, a click similar to that produced by connecting the receiver across the terminals of a condenser is heard in the receiver. However, subsequent contacts with this same good conductor will not result in subsequent clicks being heard in the receiver. This is due to the fact that the static electricity stored in the conductor causes a click when it is discharged to ground and unless a considerable amount of time elapses before successive contacts are made no additional click will be heard. However, if the insulation is impaired the conductor will not retain a static charge, hence no click will be heard when such a conductor is tested. Applying the receiver test will thus indicate at once whether or not the idle conductors or those which have been disconnected at both ends are affected.

Receiver and Battery Test

By introducing the dry cell between the receiver and ground and touching the conductors with the test wire, a click will be produced in the receiver each time an idle or disconnected conductor with impaired insulation is touched.

Receiver Test Common Battery Exchanges

In common battery exchanges the use of the exchange switchboard signal can generally be used in determining which lines are in trouble. However, the receiver is also convenient in detecting whether or not idle conductors in the cable are affected. To make preliminary test in a common battery exchange connect one terminal of the receiver to ground and with a wire or clip attached to the other terminal touch working pairs to find the battery side of a line. When battery is encountered it will cause a sharp click in the receiver which will be repeated every time a conductor charged with battery is touched. If a light click is heard the cable lug should be tapped two or three times to determine whether or not the click is caused by static discharge or battery current flow.

After determining which conductors are affected a study of the cable distribution chart will sometimes reveal quickly what section of cable contains the fault. For example: When trouble is encountered in a 100 pr. cable containing pairs numbered 1 to 100, if only conductors No. 21 to 35 test in trouble and there is a 15 pr. branch which contains this count, the task is reduced to locating the fault in the section of 15 pr. cable.

The Wireless Test Set

This set consists of apparatus called a Fault Finder for producing an interrupted current, an exploring coil and a telephone receiver. The Fault Finder is made up of an induction coil, vibrator, sometimes also an interrupter, a battery consisting of from one to four dry cells, a two-point switch, and a set of binding posts. This apparatus is commonly mounted in a compact wooden case. Diagrams of the wiring are usually shown on the lid of the case.

The exploring coil is very simple and rugged in construction. A simple coil of insulated wire is wound on a soft iron core, and the ends of the coil are terminated so that the cord tips of a head receiver may be attached thereto.

The head receiver is of a sensitive type.

The Use of the Set

The test set is designed for locating crosses, grounds, short circuits, split pairs and wet pairs in both underground and aerial cable systems. It cannot be used in locating opens. It must not be used in locating faults in loaded cables as the current generated by the Fault Finder is liable to magnetize the loading coils. Always disconnect cross-connections, jumpers and drops from conductors under test.

Method of Operation

The vibrator of the Fault Finder should be adjusted to operate at as low a frequency as is consistent with a uniform tone.

When the battery switch is closed the vibrator will operate continuously. The secondary of the induction coil is provided with two windings, "high" and "low." Cable Fault Finders, of which there are three or more on the market, are generally equipped so that either of these secondary windings are conveniently terminated on binding posts designated appropriately "high" and "low."

In locating grounds, wet shorts, solid contact, short circuits, and crossed or split pairs, the use of the low winding is generally satisfactory. However, the proper winding to use can be determined in the following manner:

Connect the conductor or conductors in trouble to either the high or low winding and then test for the tone with the exploring coil at some convenient point on the cable, noting the volume of tone in the receiver. Next connect the conductor or conductors in trouble to the other winding and note the volume of tone as in the first instance. The winding which gives the greater amount of tone in the receiver is the proper one to use in locating the fault in question.

Proper Connections

Drawings referred to as figures eight to twelve show the correct connection to use of cable conductors to Fault Finder for the various faults encountered. Connections should first be made at the office end of the cable.

Locating Grounds

For locating grounds the Fault Finder should be connected as shown in Fig. 1 A. While exploring for the tone the exploring coil should always be held on the under side of the cable in order to eliminate any effect from currents which may be flowing in the messenger strand. However, in large cables, because the different layers of conductors are placed spirally, the magnitude of the current induced in the exploring coil will be found to vary at certain points along the cable. Therefore if the exploring coil is continually held on the lower side of large cables, there will be certain points located at regular intervals not more than a few feet apart, where the tone is scarcely audible, and an equal number of points located midway between these, where the tone will be comparatively louder.

In such cases the exploring coil should be moved in a spiral around the cable sheath. This spiral movement of the exploring coil permits it to have a uniform separation from the conductor which is carrying the tone and will avoid the operator being misled by a vanishing tone when locating high resistance faults, or when the fault is a long distance from the point at which the interrupted current is applied.

ing one location against another before any opening is made in the sheath.

Cross-connecting boxes may be utilized, as test points at which to connect the Fault Finder, in order to shorten the distance between the end and the fault. The cross-connecting jumpers of the conductors under test always should be opened, to reduce the capacity effect, resulting from the conductors in the good section of cable. This

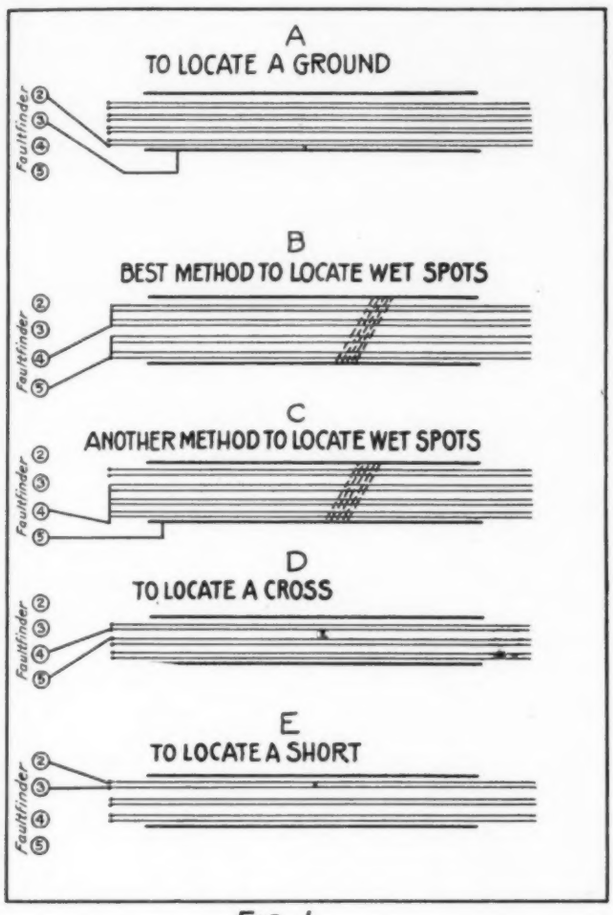


FIG. 1

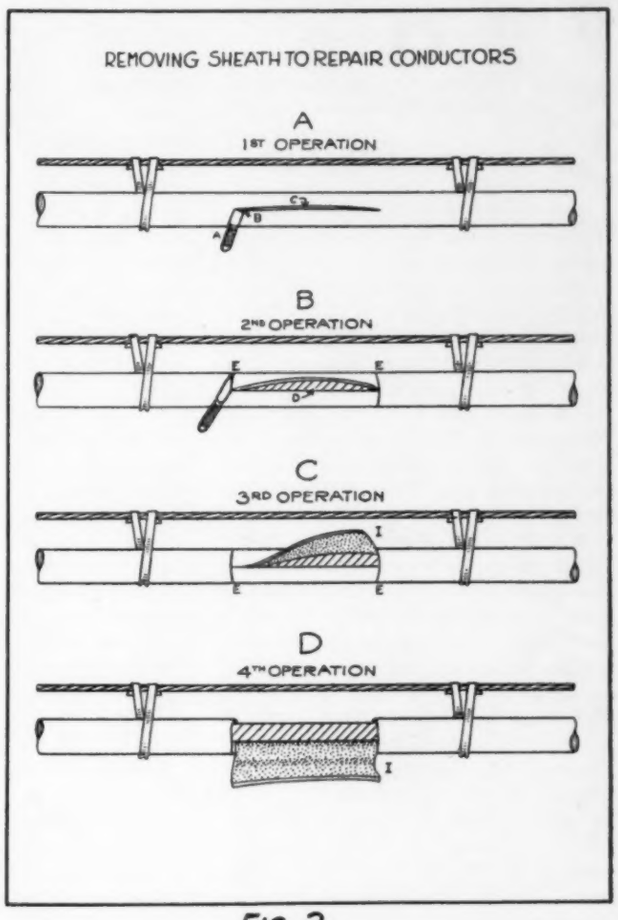


FIG. 2

When locating high resistance grounds, the tone reduced in volume will be heard beyond the location of the fault because of capacity in the cable conductors. The only way that troubles of this nature can be located is by noting the point at which a perceptible decrease in the volume of tone occurs. In these cases it is desirable and often necessary that the Fault Finder be connected to the defective conductor or conductors at a terminal which will leave the shortest possible length of conductor beyond the probable location of the fault, in order to reduce the capacity effect of the conductor beyond the fault to a minimum. In case the exact location of the fault is not apparent from the condition of the sheath, it is sometimes necessary to connect the test set first to one end of the conductors and then to the other, thus check-

is especially desirable in cases where moisture trouble is light and is located in the section of cable between a cross-connecting box and the office.

Locating Wet Spots

Choose several pairs (those showing the most pronounced trouble) and connect an equal number of pairs to each binding post of the "high" winding of the Fault Finder, as shown in Fig. 1-B. The exploring coil should then be moved along the cable as described for locating grounds. If the insulation is thoroughly wet no tone will be heard in the receiver beyond the location of the fault and if the insulation is less wet the volume of the tone may be only reduced at the location of the fault as in the case of high resistance grounds.

Another method which is sometimes used for locating wet spots is shown in Fig. 1-C, in which several pairs are connected to one binding post of the Fault Finder, and the sheath of the cable to the other binding post as in the case of grounds. Beyond the location of the fault no tone or tone reduced in volume will be heard in the receiver.

Locating Cross Pairs

For locating crossed pairs the Fault Finder should be connected as shown in Fig. 1-D. Beyond the fault no tone will be heard in the receiver.

Locating Short Circuited Pairs

For locating short circuited pairs the Fault Finder should be connected as shown in Fig. 1-E. If it is known for a certainty that the cross has no appreciable resistance, the "low" coil should be used and the fault may be positively located, as there will be no tone in the receiver beyond the fault. If, however, the fault shows considerable resistance, then the "high" coil must be connected to the conductors in trouble and there may not be any tone in the receiver beyond the fault, but in many cases the tone does not entirely cease beyond the fault, although its volume is reduced. Therefore, much care should be exercised to determine definitely at what point the tone is reduced.

To save time and the labor of riding every span, while using the exploring coil, satisfactory results may be had by climbing poles at intervals along the cable route, and making listening test at these places, until the trouble is located in a certain section or span. It is then necessary to complete the listening tests by riding that section or span in a cable car.

Making Temporary Repairs to Wet Cables

The location of the trouble having been determined, the next step is that of making repairs. The man doing the work should provide himself with a helper and such tools from the cable repair kit as will be needed temporarily to repair the cable.

Be Safe Always

Much care should be exercised in the matter of providing a safe and convenient place to work, SAFETY being the FIRST CONSIDERATION. In some instances an extension ladder supported against the messenger and with both sides of the ladder lashed to the messenger with ⅜-inch or ½-inch rope provides a suitable place from which to work. In places where a ladder cannot be used the cableman's platform should be substituted.

In the event platform is used it should be securely supported from the messenger by means of ropes, not less than ¼ inch, and properly guyed to some pole or other stationary object by ropes not less than ½ inch in diameter to prevent tipping sidewise.

Removing the Lead Sheath of the Cable

Drawings shown in Figs. 2 A to D illustrate the proper sequence of operations in removal of sheath.

The best and most convenient tools for removing lead sheath are a chipping knife, a pocket knife and a claw hammer. Start the operation by making a longitudinal cut in the sheath, as shown in Fig. 2-A. The method of holding the chipping knife for this work is shown at "A." Blows are struck with a hammer on the head of the knife at "B," and the knife is given a side motion, which opens the cut in the sheath, as shown at "C," without the possibility of injuring the insulation or conductors. The required length of this incision is problematical, and to start with it should not be longer than 6 or 8 inches and should extend equal distances on either side of the located defect. Open up the sheath with the claws of the claw hammer, as shown at "D," Fig. No. 2, just enough to expose the core so it may be examined for traces of moisture. This may be detected by discoloration both of the inside of the sheath and the paper insulation.

In the event that moisture is detected, the length of this incision should be extended far enough to either side of the crack or hole, to get past all visible traces of moisture. The next operation is to cut a circular groove around the sheath at each end of the longitudinal incision, as shown at "E" in Fig. No. 2. In doing this a sharp pocket knife is the best tool to use. Press the edge of the knife against the sheath in the location of the desired groove, then rock the knife so as to produce the same effect as if the sheath was rolled along the upturned edge of a knife blade. Continue this operation until a groove has been cut the entire distance around the sheath. Care should be taken not to cut a groove deeper than half way through the sheath. If the knife cuts entirely through the sheath, a sharp edge will be produced at the inner side of the sheath and the insulation may also be damaged. The sheath may now be turned back, as shown at "I" in Fig. 1-C, by means of the claw-hammer. If properly cut and removed, the inside of the remaining sheath at each end of the incision will be rounded and smooth.

Wrap freshly boiled cotton tape, about ¾ inch in width, around the core at the end of the sheath. Work the tape back, using a thin dull tool about ½ inch between the sheath and the paper wrapping of the core to protect the core from injury at the edge of the sheath. The tape should be applied so as to cover the paper wrapping around the core of the cable for about ½ inch from the ends of the sheath. The paper wrapping should then be removed from around the core up to but not from beneath the cotton wrapping. Next separate the wires enough to allow your fingers to pass freely between them. If tension on the cable conductor prevents a satisfactory separation, secure slack by removing the hangers for about 3 or 4 feet and forcing the cable away from the messenger in the center of this section, after which replace the hangers.

Examination of Insulation and Conductors

Before boiling out the wet spot an examination should be made to see that the paper insulation is not damaged, and that the conductors have not been corroded off due to an electro-chemical action, which sometimes takes place if the trouble has been of very long duration. Evidence of electro-chemical action will be visible, due to discoloration of the paper insulation, giving it a greenish or copper sulphate colored stain. In cases where defective insulation or conductors which were open or reduced in size by electro-chemical action are discovered, these conditions should be repaired before progressing further.

Repairing Damaged Conductors

Open conductors should be repaired by splicing in new pieces of core wire. This core wire may be secured from waste pieces of cable resulting from construction jobs or other sources which may be available in the storeroom. Wire for this purpose should be boiled out with hot paraffine and properly stored with other cable material.

When open conductors are discovered, be careful to disturb them as little as possible, before the adjacent ends are connected, because of the possibility of getting the conductors mixed and splicing wrong pairs together, when both conductors of more than one pair are open. To avoid this carefully lift one pair from its place in the layers and repair it before disturbing the next pair.

Preparation of Paraffine

The paraffine should be prepared for use as follows: Place the furnace on a level surface, away from sidewalks or cross-walks or any inflammable article. The furnace SHOULD NEVER be placed WITHIN 10 FEET OF A MANHOLE in which a man is working, because of the danger to the workman in the manhole if the pot of paraffine should be accidentally upset. See that the paraffine pot is filled about two-thirds full with paraffine, and if a large pot is used, heat the sides of the pot before placing it on the furnace. This will allow the paraffine to circulate around the sides of the pot and prevent a possible explosion when it is being heated from the bottom only. After the paraffine has been melted around the sides of the pot, place it on the furnace and heat it to a temperature of 375 degrees. In cases where thermometers are furnished place the thermometer in the paraffine so that the bulb will not touch the bottom or sides of the pot, otherwise the temperature recorded will not be correct. When the thermometer registers the proper temperature remove the pot from the furnace and begin the process of boiling out the cable.

If a thermometer is not provided, determine the proper temperature of the paraffine by means of an approved visual test. To the inexperienced man the placing of a few drops of water in the hot paraffine is probably the most reliable test. If after a pause of about one-half second the liquid begins to sputter and the water is thrown out, the paraffin is hot enough for use, but if it does not sputter, continue the heating process. A thin gray vapor rising from the paraffine will indicate when nearly the proper temperature is reached.

(Continued on page 49)

Everyday Telephone Helps

First of a Series of Articles for Beginners; for Students, Small Plant Managers, Rural Line Owners and Others — Fundamental Facts, Principles and Practices of Theoretical and Applied Telephony

By P. Kerr Higgins

This series of articles dealing with everyday telephone problems is primarily intended for the new man in the telephone field or the one who has had little or no training along that line and will appeal more especially to those owning or employed in the small telephone plants. And so it will be the object of the writer to treat the subject in as simple a form as practicable, avoiding all technicalities wherever it is possible to do so.

P. Kerr Higgins

It is impossible to treat telephone problems entirely without reference to some technical matter, but in so far as possible, this will be done. It is also the experience of the writer that very few of the new men entering the field in the smaller exchanges have the necessary knowledge or ability to read the circuits, and so this, too, will be avoided in so far as it is possible to do so, and where necessary to give circuits, they will be given in as simple a form as possible, eliminating all technical terms.

Heretofore, it has been customary to begin such a series of articles with the Central Office Equipment, but it is the belief of the writer, drawn from his experience, that, regardless of all that has been written about sub-station equipment, it is surprising to find how few of the telephone trouble men understand the functions of the parts used or their relation to each other in the subscriber's telephone. In order to simplify matters, we will hereafter call the telephone in the subscriber's station the sub-station equipment.

Installer One of First to Meet Subscriber

After the application by the subscriber for telephone service, the first person to come in contact with the subscriber is the man who installs the telephone, and right here it might be well to emphasize the importance of this man's attitude toward the subscriber, as this is laying the foundation for all future relations between the public and the company and the attitude and behavior of this individual at the time of installation may mean a great deal to the company in days to come. The impression that he leaves with the subscriber will have very much to do with the relationship existing between the subscriber and the company.

A Neat Appearance Is Important

The appearance of the installer, too, has much to do with the impression that he leaves with the subscriber. This does not mean that he should wear fancy clothes or even a white collar, but that his general appearance presents in so far as possible a neat and clean appearance. It is therefore suggested that the installer should have with him as a part of his equipment a suit of overalls and a large piece of oilcloth on which to place his tools and which will keep together the scrapings from the wire and any other work he may have to do which would otherwise leave particles on the floor.

Again let me emphasize the fact that in this case, as in most others, the installer is representing the attitude and policy of the company toward the subscriber for whom he is making the installation, and hence the company will be judged largely by his attitude and demeanor while on the job. Every effort should be exerted to make the installation in as satisfactory a manner as possible to the end that another visit will be unnecessary.

In practice it is frequently found that after the installation is completed there is trouble somewhere between the substation and the Central Office. When this occurs my experience has been that it is best to advise the subscriber as to the nature of this trouble (if known) and to tell him that the matter will be followed up to a successful and prompt conclusion rather than leave the subscriber to guess what the trouble may be.

Very often an installation has been made and several days elapse before the telephone is working, and this leaves a very bad taste in the mouth of the subscriber, which can and should be avoided. In order to avoid such conditions as this, the writer has made it a practice before making the installation to test out the cable pair and connect through to the switchboard, testing from the cable end into the switchboard to be sure that everything is O. K. before stringing the subscriber's line, and then to take his test set and call into the central office and make sure everything is all right before he begins his installation. If this is done it will prove very much more satisfactory to the subscriber and also to the installer. Try this once and you will be surprised at the excellent results obtained.

A Proper Equipment of Tools

In an effort to improve the efficiency of the installer, the following information is given from the experience of the writer:

It has been said that poor tools make a poor workman. While this may not always be true, there is a great deal of truth in it, and so it is important that not only should the installer have a complete kit of tools, but that they should be in good working condition, more especially the screw drivers. The writer has found in almost every case the installer trying to use screw drivers unfit for use, thus making a mess of the heads of screws, damaging woodwork, etc., when the use of a file for a few minutes would put these screwdriver blades in first-class condition and so fit any screwhead and save slipping off and damaging woodwork and destroying the head of the screw. Every installer has his own idea as to what tools are necessary in doing this class of work, and the following are merely suggested as a nucleus to which could be added from time to time as his experience warrants other tools.

1. An assortment of screwdrivers of various lengths and sizes.
2. One pair of five or six inch, long-nosed pliers.
3. One pair of diagonal pliers.
4. Several files, different sizes and grain.
5. One claw-hammer.
6. One pair of linemen's side cutting pliers.
7. One pair of cable scissors (snips).
8. One brace.
9. Assorted bits.
10. Several sheets of assorted sandpaper.
11. Several sheets of emery cloth.
12. Milnite nails, half-inch and three-quarter inch.
13. An assortment of screws.

14. One gimlet.
15. Porcelain tubes (assorted).
16. One knife.
17. One small pinch bar.
18. One test set with test clips attached.
19. One tool bag.
20. One small saw.

In visiting a large number of small exchanges, it surprised the writer very much to find that it is almost impossible to get the installer or trouble man to carry constantly with him his test set, and the amount of time wasted because of this fact is enormous. To an "old timer" it is almost incomprehensible that an installer will persist in making installations or hunting trouble without a test set or without having with him an assortment of miscellaneous parts, such as receiver diaphragms, extra receiver, transmitter, ringer movement, extra batteries, mouth-pieces and many parts which are so essential in doing such work and save so much time. I often find telephone men, even though they have automobiles at their disposal, who persist in going to make installations or to clear trouble without a test set and proper tools to do the work.

The above remarks are perhaps not apropos in dealing with installation, but I am tempted to emphasize this matter at this time, as it is extremely important.

Instrument's Good Appearance

Many installers are also careless in selecting and taking out a telephone to install at a subscriber's station and take an instrument which is unfit to go into even a livery barn. It is therefore important that no telephone should be installed unless it is either new or has been thoroughly overhauled and looks as good as new and is in first-class working condition, having been tested out prior to leaving the office. The importance of this matter cannot be overestimated. It is suggested that on rainy days and when trouble is at a low ebb that the owner or empleyee at the small exchange should utilize his time in overhauling his equipment not in use in the storeroom rather than spending the time in the poolroom or the drug store or the cigar store or standing on the corner "chinning" with those who are not helpful to him in building up his business or that of his employer.

Equipment

Sub-station equipment as used here is intended to cover all wiring and equipment from the pole nearest the subscriber into and including all the equipment and wiring on the subscriber's premises.

For our convenience we will divide this subject into four main divisions: (1) Equipment, (2) Wiring, (3) Protection, (4) Trouble Diagnosis and Remedy.

In practice we find three principal classes of sub-station equipment: (1) Local Battery (magneto), (2) Common Battery (Central Energy), and (3) Automatic.

In each of these classes we find three types, namely, wall sets, desk sets and combination sets.

The sub-station has a surprisingly large number of parts reaching into the hundreds, each one distinct in itself, and so it is almost impossible to go into detail as to all these parts, and this article will treat only of the principal parts, eliminating such parts as binding posts, screws, hinges, wiring, etc.

The "anatomy" of the sub-set should be studied.

We should approach a sub-station set as a physician would a patient, and so our first thought is to become familiar with the "anatomy" of the instrument with which we are trying to become familiar. The interior of a typical local battery sub-set is shown in Fig. 1. The telephone instrument naturally divides

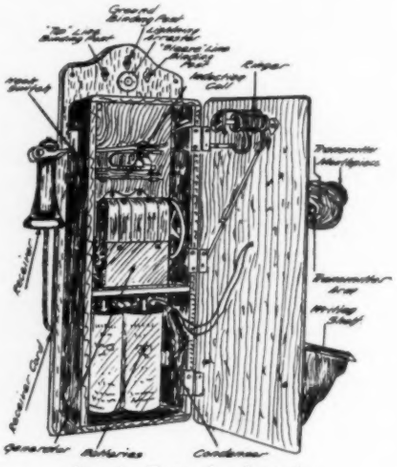


Fig. 1—Typical sub-station

itself into the following distinctive elements: 1, The inward signaling circuit; 2, the outgoing signaling circuit; 3, the talking circuit; 4, the hearing or receiving circuit. The apparatus in each circuit will be described briefly in the following paragraphs, more extended explanations being given later;

1. Signaling Apparatus

The signal apparatus (outward) is of two kinds: 1, The Magneto Generator, which is used in local battery or magneto service; 2, Central Energy Calling, which is used in common battery service. The signaling apparatus inward is practically the same in both cases except that in the common battery (or Central Energy) type, the condenser is used in series with the ringer movement.

2. The Receiving Circuit

This circuit consists of the telephone receiver, receiver cord, coil, receiver hook and sometimes a condenser added.

3. The Talking Circuit

The talking circuit consists of the transmitter, battery supply, receiver hook and coil, these principal parts being connected together in a logical and prearranged manner by means of wires so as to form a complete circuit. The coil is in two parts, primary (or transmitter) and secondary (or receiver) circuit.

The receiver transforms the currents received into sound vibrations, the transmitter on the other hand transforming the voice (or sound) vibrations into electric currents, which in turn are carried to the receiver directly or indirectly by means of the wires already mentioned. The battery supply is of two kinds. In the case of the local battery or magneto service, the current is produced locally by one or more cells of battery. In the central energy type the battery is supplied from storage cells at the central office over the line to the sub-station.

Making the Installation

In order to save time and assuming that a brand new telephone is to be installed, we will now proceed to discuss the method of installing the telephone and later take up the details as to its component parts and their operation.

The location for the instrument is very important and great care should be taken in deciding just where it should be placed. Naturally the subscriber's wishes must be consulted in this matter, but if perchance the location suggested by him should not meet with the technical requirements of the instrument, great care should be taken to explain to him why such a location is not to be desired and have him select some other place. Having this in mind, it might be well to state some of the technical requirements as to the position of the wall telephone.

Some Pointers on the Location

First: Avoid vibration. *Second*: Avoid a noisy location. *Third*: Avoid dampness. *Fourth*: Never locate a telephone closer than three feet to a window, if a wall telephone, and six feet if a desk set. *Fifth*: The transmitter should be placed at a height convenient for the average member of the family who is to use the instrument, being usually about five feet from the floor to the bottom of the transmitter. As a rule the transmitter is flexible and has a range of from two to three inches, being movable up and down for the convenience of the patron. Be very careful to see that the magneto type instrument is not placed in a position

where it will interfere with the proper functioning of the crank which operates the magneto generator. *Sixth*: The receiver and receiver hook should be in such position that the taking down of the receiver for use will not be interfered with. *Seventh*: The telephone should never be placed where it is liable to injury from doors or other interfering objects. Respect the subscriber's wishes in so far as possible and practical as to location and height. Use No. 8 round head screws (blued) an inch and a half to two and a half inches long (according to conditions.) If necessary, the wall should be blocked out with wooden blocks nailed to the wall (plugging same if necessary) and screwing the telephone to the wooden blocks so that the telephone is from one-half to one inch or more away from the wall. This should only be done where no other suitable location can be obtained.

In locating desk sets the bell box should be placed some distance from the floor if possible. It is found undesirable in practice to use a cord connecting the bell box and the desk set longer than six feet, and where this distance is exceeded duplex (two wires), or triplex (three wires), as the case may be, should be used. In so far as posible avoid making permanent connections on desks, etc.

Where a telephone is installed in a booth, if practicable, the bell box should be located outside the booth, so that it may be readily heard by the subscriber. Always place the telephone where it will be convenient for inspection at all

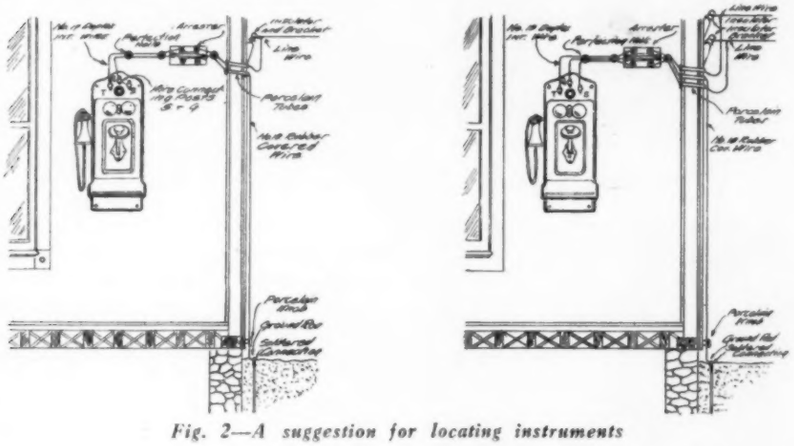


Fig. 2—A suggestion for locating instruments

times without moving furniture. Never fasten telephone equipment to desk or furniture without the consent of the subscriber and in so far as possible, this should be done under his supervision. Conceal all wires wherever it is possible and practicable to do so. The experience of the writer has shown that in small exchanges installers are usually very careless in this matter and not only does the work look bad, but frequently later develops trouble due to injury or other causes. In magneto service an important rule is to always locate the batteries as close to the instrument as possible, using not less than No. 18 wire for the connections. Fig. 2 is a suggestion of how the instrument may be installed.

Different Types of Wall; Different Supports for Instruments

In installation work several kinds of walls are met with, especially in the cities. First, brick; second, concrete; third, hollow tile; fourth, metal lath faced with plaster; fifth, stone; sixth, woodwork; seventh, wooden lath and plaster. The method used in determining the character of the wall is to tap it lightly with a hammer. This in the case of lath and plaster will also locate the studdings as it will have a hollow sound on the lathing and solid on the studdings. On such walls or wooden walls only screws are necessary, but in the case of brick or stone the wall must be plugged with wooden blocks using a brick star drill to make the holes in brick or stone wall. The location of the screw holes are determined by passing a brad awl gimlet or other instrument through the holes on the telephone. When walls are plugged, a wooden plug should be driven into the drilled hole and then sawed off flush with the wall. Use only seasoned dry wood for the plugs and make them large enough to give you a margin of safety and to hold the instrument firm. In hollow tile or other walls the use of expansion or toggle bolts has been found very convenient. Never fasten to lath or plaster. Always locate and fasten to studding on lath and plaster walls. The use of a board the same size as a telephone on a stone or brick wall after plugging is also found very desirable and should be used if possible

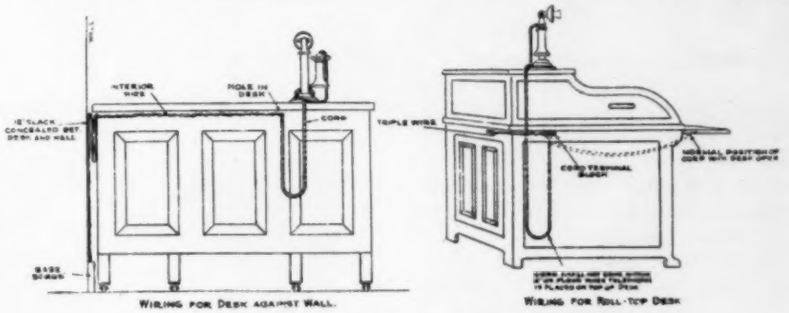


Fig. 3—Suggestion for desk-set wiring

and more especially where a pay station coin box or extension bell goes with the telephone.

Desk Set Cords Should Be Kept Dry

Judgment should be used on the part of the installer in placing desk sets for the reason that the cord connecting the bell and the desk set is very susceptible to injury from moisture. Recently a moisture proof cord has been developed and its use in many cases has minimized this difficulty.

In no case should the cord be allowed to touch the floor and as previously stated great care must be taken to place the desk set and cord away from a window which is liable to be left open at any time. The writer has had a great deal of trouble on this account especially along the gulf coast where the air is permeated with moisture even although seeming to be dry to the casual observer. In such climates a moisture proof cord is imperative. When absolutely necessary to locate the bell box on a desk, it should be placed under the desk and the smallest possible hole made in the rear of the desk close to the top. In order to relieve the strain on the cord it has been found convenient to use a clamp to hold the cord in the required position or if a clamp is not available to tie a knot in the cord. Where the cord (or wires) come through a wall or projection having dampness, a porcelain tubing or flexible conduit should be used in such a manner as to prevent the moisture from coming in contact with the conductor.

Some suggestions for location of desk instruments are given in Fig. 3.

In the next article the function of various parts will be considered so that any trouble that presents itself can be diagnosed.

LINE AND DESK

Multiple Wood Conduit

An interesting development in underground conduit is a creosoted multiple wood conduit developed and being manufactured in Atlanta, Ga.

This conduit is built up of bottom, intermediate and top pieces. The top and bottom pieces, or cap and base, are milled to form two half ducts and can be placed together to form two duct sections. The intermediate pieces or fillers are milled to form two half ducts on each side. One side of the filler carries three grooves, one on each side wall and one on the center partition; the other side carries three tongues in corresponding positions. Corresponding tongues and grooves are in cap and base. One filler placed between a cap and base forms a four-duct section; after that each filler added increases the number of ducts by two. The assembled pieces are bound by wires and form complete sections of multiple conduit. After assembly the conduit is treated with dead oil of coal tar to preserve it.

This conduit is laid either directly upon the bottom of the trench or upon a creosoted plank, as the nature of the soil requires. In soft or sandy soil the bottom plank is considered necessary.

After laying a 1½-inch creosoted plank is laid on top for protection.

The joints are made by abutting the members of adjacent sections and wrapping the joint with a strip of tarred burlap. At the joint alternate members of the section are offset longitudinally about one inch, giving an overlapping broken joint which centers the ducts and holds them permanently in line.

This conduit can be laid very rapidly. Many timed sections showed a speed of 1,200 or more duct feet per hour for a gang of five unskilled, tho practiced, laborers. One such gang with about two weeks' practice laid in four hours 8,000 duct feet.

A trench from manhole to manhole can be opened, the ducts laid, and trench refilled in less than one day. About two hours is required to lay the average section. The filling can follow the laying right up to the last piece laid, except where water tamping is required.

The completed duct structure is water-tight, therefore soil and silt proof. The inner walls of the ducts are very smooth and therefore full sized cables can be pulled in rapidly and without the use of lubricant. The observed speed has been about 50 percent faster than other forms of conduit.

Requiring less wood, less oil, and less labor to produce, the cost of multiple wood conduit is less than the usual single bored type. The ease and speed of laying further reduce the completed cost. Conduit, plank, burlap and tar are the only materials required, and no special tools are required. Several hundred thousand feet have been laid in the Southern territory with uniform satisfaction.

One of the photographs shows two gangs in action. Two men in foreground handling a section in the trench (the hammer is used for tapping the members home to make tight joints), one man following with tar bucket sealing the joints, two men on bank serving duct, constitute first laying gang. In rear is second gang laying second run of eight ducts to make complete 16-duct run.—**Contributed.**

Photo courtesy Southern Telephone News

Unskilled labor makes speed with multiple wood conduit

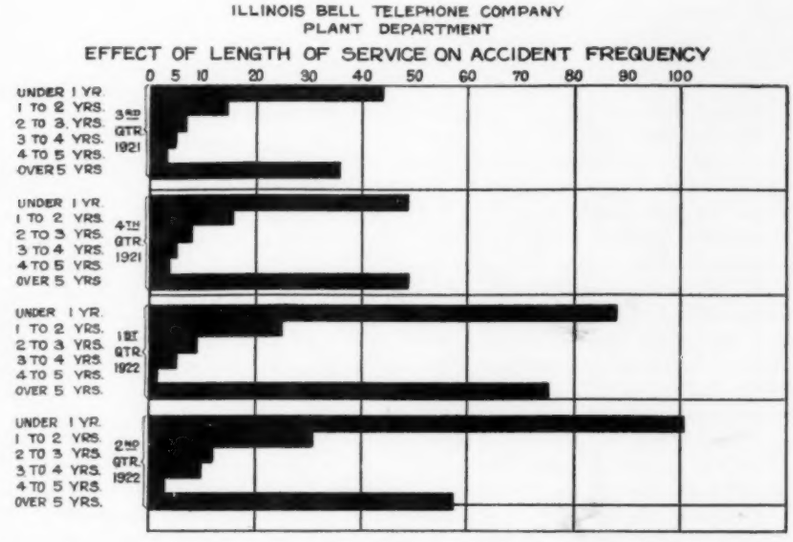
Photo courtesy Southern Telephone News

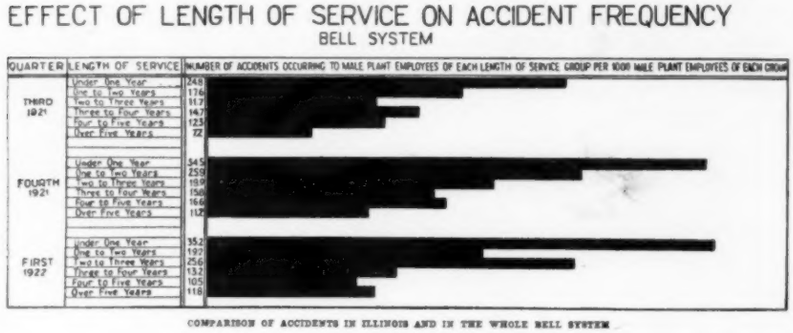
Close-up of multiple wood conduit

Length of Service and Accident Frequency

That there is a definite relation between the length of service of plant employees and the frequency with which accidents occur is the conclusion drawn from a study made by the Illinois Bell Telephone Co. In a recent number of Bell Telephone News two charts were presented showing the results of the study in the plant department of the Illinois company and the Bell System as a whole. One curious and as yet partly unexplained fact is that the frequency of accidents among employees of more than five years' service is greater than among employees of one to four years' experience. Naturally, the class of employees who have the greatest number of accidents are those of less than one year's service.

Opinions of division plant men were collected in order to explain the cause of increased frequency of accidents among older employees and they are quite generally of the opinion that it is because men grow careless and take more chances as they grow older on the job. While this may be a partial explanation, it does not show why the experience of the Illinois company is different from that of the Bell System as a whole. The fact that this condition has occurred consistently, however, indicates that there must be some very definite reason and emphasizes the necessity of making the campaign of instruction in safe methods of working continuous rather than sporadic. It shows that older employees must have the matter of safety kept before them at all times in order to keep them thinking of doing their work in a safe manner.


ILLINOIS BELL TELEPHONE COMPANY
PLANT DEPARTMENT
EFFECT OF LENGTH OF SERVICE ON ACCIDENT FREQUENCY
0 5 10 20 30 40 50 60 70 80 90 100
UNDER 1 YR.
1 TO 2 YRS.
2 TO 3 YRS.
3 TO 4 YRS.
4 TO 5 YRS.
OVER 5 YRS
3RD QTR 1921
4TH QTR 1921
1ST QTR 1922
2ND QTR 1922


EFFECT OF LENGTH OF SERVICE ON ACCIDENT FREQUENCY
BELL SYSTEM
QUARTER
LENGTH OF SERVICE
NUMBER OF ACCIDENTS OCCURRING TO MALE PLANT EMPLOYEES OF EACH LENGTH OF SERVICE GROUP PER 1000 MALE PLANT EMPLOYEES OF EACH GROUP
THIRD 1921
FOURTH 1921
FIRST 1922
Under One Year
One to Two Years
Two to Three Years
Three to Four Years
Four to Five Years
Over Five Years

COMPARISON OF ACCIDENTS IN ILLINOIS AND IN THE WHOLE BELL SYSTEM

BUGS WE HAVE SHOT

For a long time this station went in trouble regularly every night at 9 p. m. and as regularly came clear at 6 a. m.,

which baffled the troubleman. Then one morning he called around at the subscriber's house in the vague hours before 6 a. m. At last—the mystery solved! From the binding post of the set dangles the subscriber's watch—its usual resting place upon said subscriber retiring for the night. Short circuit? Well, rather!—Telephone Review.

A WYOMING PROBLEM

Is There a Reliable Motor-Driven Sleigh Made for This?

Some reader somewhere probably has overcome a problem similar to mine and may be willing to let me profit by this experience.

The problem referred to is the clearing of toll line trouble in Wyoming, where the lines run along country roads and highways; where we have enough snow to make automobile travel out of the question and where at times horses cannot get through. Ordinarily the snow is not over two feet deep, but drifted badly. However, detours are possible across the prairie, where fences are scarce, so that two feet is a good average. At such times that horses can travel the going is very slow and, due to the sparsely settled country, there is no place for men to eat or sleep, so very little work can be accomplished.

We have heavy wind and sleet, which causes considerable trouble and, altogether too frequently, total failures. The situation really evolves into two problems:

First—That of transporting two men on ordinary trouble.

Second—Transporting a gang or gangs to restore service after total failures.

On account of there being no place for men to stay, as already explained, it is a question of:

First—Using some kind of portable camp quarters, or

Second—Being able to travel quickly back and forth from the nearest town, which ordinarily is 20 miles distant from the job.

The objection to the camp is that anything of this kind must be more or less bulky—especially to take care of a gang—hence the logical solution would appear to be some means of fast traveling. My thought is that possibly there has been some sort of a motor-driven sleigh perfected which we could get.

It certainly would be interesting to us in Wyoming, with our 22,000 miles of toll line—and 400 of that a connecting link in the transcontinental circuits which *must* be kept working—to read the experiences of how others "go get" their toll trouble.

C. J. McKee,

Toll Wire Chief, Mountain States Telephone & Telegraph Co., Cheyenne, Wyo.

A Practical Test for Local Battery Instrument Trouble

One of our subscribers asks that we give the proper way of testing a local battery telephone. While this will ultimately be covered in the series of articles by P. Kerr Higgins which is beginning in this issue, one or two suggestions made at this time may prove helpful.

We know one repairman who has systematized his tests of a local battery telephone into four steps. These four steps are as follows:

1. Turn crank with receiver on hook. If silent ringing type, connect ringer cut-off spring on generator to generator so that bell will ring.
2. Remove receiver and place at ear, then turn crank.
3. With receiver held at ear and hook held down turn crank again.
4. With receiver at ear and hook up, short circuit line and tap transmitter.

The first test is a test for continuity of generator and ringer circuits. The second test is a test of continuity of the receiver circuit, including secondary of the induction coil. If the circuit is O. K. the generator current will be heard in the receiver. The third test is a test to see that the hook switch springs clear the receiver circuit from the line when the hook is down, and the fourth test is a test of the transmitter circuit if the receiver circuit is found to be O. K. on the previous tests.

These four tests require only a few seconds of time and if they are made in the order given will give a complete test of the various circuits. Practically any ordinary trouble will show up on one of the four tests and they have the advantage of telling in which circuit the trouble lies.—**Staff Contribution.**

Joints Between Iron and Copper Wire

In connection with the use of copper clad drop wire on an exchange where the line wires were galvanized iron, the writer had to solve the problem of making a satisfactory joint between the iron and copper surfaces. Experiences of long years have taught that corrosion will soon take place and cause high resistance joints, while other experience has shown the difficulty of making a good soldered joint out on the line where the joint usually has to be made.

To meet the difficulty, the writer has reverted to a practice common in the old days of making grounds on water pipes before the days of the modern ground clamp. This practice is the old-fashioned tinfoil joint. The iron line wire is cleaned so that it will have a bright surface and is then wrapped with tinfoil. The copper clad drop is then wrapped around the line wire in the usual way. A layer of tape is then served around the joint and a connection is made that will last for years.

Joints of this type which were made eight years ago have been found to be in perfect condition. The same plan has also been used for connections to ground rods with good success.—Contributed by H. C. Marsh.

Some Pointers on Poles' Breaking Strength

W. L. Martin, chief pole inspector of Northwestern Bell Telephone Co., gives the following notes on poles in a recent number of Northwestern Bell Magazine:

"The pole question is of vital importance to the telephone company and to the lives of its employees. Each and every man should be trained to know whether the pole for the place intended is the right pole, or if there is a hidden defect which will endanger the property of the company and the life of the lineman. The breaking point of a good pole is from three to five feet below the center. The breaking point of a defective pole is at its most defective spot, anywhere from the top to the ground line.

"The approximate breaking strength of sound poles, that is, the strain from the top of the pole, is as follows: Class triple A, 3,600 pounds; double A, 3,200 pounds; single A, 2,800 pounds; class B, 2,400 pounds; class C, 2,000 pounds; class D, 1,600 pounds; class E, 1,200 pounds; class F, 1,000 pounds; class G, 800 pounds."

People Seldom Heard from—The Installer

With his kit of tools he goes into the homes of rich and poor and puts in instruments. The commercial man sees the subscriber when said subscriber is dolled up in fashionable clothes and furs. The installer sees him or her, often as not, in a dressing gown and house slippers. It's the other side of the picture.

Life never becomes motonous for the installer with a keen eye and a sense of humor. No two jobs are alike and the subscriber is always apt to ask some amazing question that will bring laughter when told to the gang back at headquarters. The question may be in sputtering Italian one hour and cultured English with a Harvard accent the next, with all sorts of American in between.

The places an installer sees and goes into would make any explorer jealous. From a plumbing shop to the vault of a bank is all in the day's orders. The old saying about one-half of the world not knowing how the other half lives does not fit the installer. He knows the other half, too.—The Transmitter.

BUILDING and BUYING

Belmond Telephone Co., Belmond, Ia., will rebuild some of its rural lines this summer. T. A. Davenport is president and manager.

Hardin Telephone Co., Hardin, Ky., intends to replace its overhead wires with cable this summer and will be glad to receive suggestions. L. C. Starks is manager.

The Frankston (Tex.) Telephone Exchange will replace some of its outside plant equipment this season. C. E. Petty is owner and manager.

The Tampico (Ill.) Farmers' Mutual Telephone Co. intends to do considerable reconstruction work this year. John H. Daley is manager.

Effington Telephone Co., Urbank, Parkers Prairie, Minn., has ordered a carload of poles to repair its stub lines. Thos. Koep is secretary-treasurer of the company.

Peninsular Telephone Co. plans to spend approximately $500,000 in enlarging its local and toll facilities in the west coast and southern sections of Florida, according to an announcement from the company's headquarters at Tampa.

Within the next three years the Southwestern Bell Telephone Co. plans to spend approximately $100,000 enlarging its facilities at Springfield, Mo.

An exchange building costing $150,000 is to be erected at Franklin, Pa., by the Petroleum Telephone Co.

The Lynch (Neb.) Telephone Exchange will do some rebuilding this season. C. W. Jurgensen is manager.

Approximately $25,000,000 will be spent by the Bell Telephone Co. of Pennsylvania in expanding its facilities this year.

Skowhegan, Me.—Charles F. Smith has been appointed manager of the Farmers' Co-operative Telephone Co. here.

Work on the $100,000 building of the Ashtabula (Ohio) Telephone Service Co. is to start June 1.

Adairville, Ky.—A. P. Vaughn, of Luverne, Ala., has bought the Adairville Home Exchange from L. M. Brown. Mr. Brown plans to buy a telephone company elsewhere.

Making Patrons Partners

Ideas Employed by a Public Utility Company That Has Successfully Campaigned for "Consumer Ownership"—Instructing the Employees in Stock Selling

By Roy Dickinson*

The fact emphasized in the newspapers recently that many rich investors are putting much of their money into tax-exempt securities has made the small investor more important than ever before. It is the man with the hundreds and thousands, more than the man with the millions, who is helping run modern industry. This fact has given greater emphasis to the idea of consumer ownership, the selling of securities in a company to people who buy its products. All sorts of companies, from automobile concerns to biscuit makers have from time to time adopted this plan with profit. They have been able to obtain new money at a cost of from 5 to 8 per cent, increase the morale of the organization when its members are used as selling agents and acquire an extra army of boosters for the product among the thousands of new stockholders.

Public utility companies, such as the electric light, gas and street railway and power companies, have been using the idea of customer ownership with success. When a householder owns a part of a strong and growing home company, and shares in its earnings, the company is able to distribute a growing proportion of its earnings among local people whose friendship and co-operation are so necessary for its continued success. The people who make the company's earnings possible get a share in those earnings. To the company this plan of customer ownership means a steadily increasing measure of public good-will and customer co-operation. To customers and company it gives a mutual interest in bringing to the territory factories and mills, business and growth, population and prosperity.

At a meeting of a committee of the National Electric Light Association in New York in December, fifteen companies comparing notes discovered that together they had sold in 1922 something over $100,000,000 worth of stock to their customers. This shows the trend of the custom which is gradually becoming very important both in the financing of the company, in winning consumer co-operation, and incidentally training a great many members of the company's organization in selling who had never before had sales experience.

The Experience of a Veteran

In all these plans advertising has played a big part. It has been suggested that a great many more industrial companies will take up the plan this year; that the railroads have been seriously considering it, and are logical candidates for the plan. With these facts in mind and a realization that an important trend is involved, I have set down here some of the experiences of the Central Maine Power Company of Augusta, a veteran in the field of consumer ownership which has by its unusual methods secured more preferred stockholders, in proportion to its size, than almost any other company in the country. This company for years has been able to do its financing on a 6½ per cent basis, when many others were paying 8 per cent. For many years it has done its major financing through the sale of preferred stock largely to its own customers. It uses newspaper advertising in every paper in the territory covered. In addition to this, it uses illustrated advertisements, booklets, lithograph circulars and issues a weekly house-organ to promote the sale of stock. In working a new town the salesmen call on 25 per cent of the people in that town—an intensive program which would help in the sale of almost any product.

The plan of the Central Maine Power Company is an elastic one which can be used by street railways, railroads, gas companies, and could be borrowed by almost any industrial company which has satisfied customers. This company has also discovered that preferred stock selling does not and need not interfere with the sale of bonds through the regular channels. Bond houses are more than satisfied to see a strong preferred stock equity because it naturally improves the position of the bond. There is little conflict between stock and bond selling, because in a general way the stock campaign reaches a different class of investors.

Percy H. Whiting, who for many years has had to do with the security department of this company, says: "The basis of all customer ownership selling is aggressive advertising. This is the secret of reaching the small investor. It is the secret of cutting the cost of selling and of maintaining the price. I maintain that a great railroad, like the Pennsylvania, for example, through advertising, could sell an almost unbelievable amount of preferred stock through its employees to its customers. The basic appeal of the advertising would be the same self-interest appeal that we in connection with other gas and electric companies are using.

I asked Mr. Whiting whether trained full-time salesmen or ordinary employees were most successful in preferred stock selling. He said:

"Employee selling will always be used. It is cheaper, for one thing, and is ideal when only a small amount of capital is needed yearly. It has the virtue of making stockholders of a lot of people that regular salesmen would never even find—much less sell. It also has an intangible but very real advantage in that it gets employees thinking in terms of one of the important functions of the public utility business—financing. Before the days of customer ownership campaigns the regular run of employees didn't know that financing was necessary. They did not see any connection between a security issue and their chances of a better job. Now they do see the connection and are better employees for seeing it.

"But the trend in customer ownership selling is toward selling by regular full-time salesmen. This is because employee selling soon runs out. Employees sell their friends, relations and neighbors, and then a good 90 per cent of them are done. Perhaps the other 10 per cent develop into fair salesmen but their volume of selling at best is low.

"The chief weakness we found when we started employee selling was the fact that we were dealing with linemen, wiremen, meter readers, office workers, station operators—people who couldn't sell, and knew it.

"We used to go to these people and tell them we wanted them to go out and 'sell stock.' We could kid some of them into buying it, but the bulk of them never even started.

"So we figured around a bit. Obviously we couldn't make a wireman sell stock. It would be just as reasonable to expect to make me 'shoot trouble' or balance the books. So the

(Continued on page 36)

* *This article is reprinted from Printers' Ink, a national authority on advertising and selling.*

OPINIONS AND COMMENTS

TECHNICAL BOOKS ON THE TELEPHONE

One of the strange things about the telephone industry is the scarcity of technical books. Until the recent publication of the second edition of a well-known general text, there has been no book in print that covered the field in a comprehensive way. Books dealing with special portions of the field are practically non-existent.

An exception to the latter statement must be made in the case of automatic central office equipment and one or two scattering books on other portions of the art. Equally strange is the fact that most of the recent books have been published in England. One publisher has projected a series of texts of which two, one on transmission and one on printing telegraphs, have been published.

As matters stand at present, the ambitious telephone employee or the technical student who wishes to make a study of the field in order to enlarge his knowledge and usefulness, finds great difficulty in securing material to work upon. While there is a great mass of material in scattered publications, it is not available to the greater number of men.

Many of the large operating companies and manufacturers have compiled manuals of construction, installation and operation that would serve admirably for study if they were available in book form to the ordinary purchaser. If they would not serve in their present form, at least those who have prepared them are qualified to revise the material into text-book form so that they would be available. Why can we not have some of them published?

RADIO ON POWER LINES

The use of high frequency telephone or "line radio" on power lines is being experimented on by a number of power companies, and there is some cause to believe that such a system may be an additional cause of inductive interference on telephone lines. This is especially true if the transmission frequencies are in the audible range and if powers of the magnitude of radio telephony are used. We have not heard that any telephone company has experienced difficulty from this cause, but it is very necessary that the telephone companies operating in the neighborhood of power companies which are experimenting along this line should keep themselves informed of the progress of the work. In this way if any cause of trouble does develop, the developing of methods of co-ordination can be made a part of the development of the system for line radio before expensive equipment is installed and placed in service.

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TAKING CARE OF THE DEMAND FOR SERVICE

One noticeable fact which may be learned from the figures presented in the annual report of the American Telephone and Telegraph Company is that the station growth of the Bell system during 1922 was about 6.6 percent, while that of connecting companies was about 1.5 percent.

Several reasons may be advanced for that condition. Among them are that the growth has taken place principally in cities of 50,000 and over, where the Bell has by far the greater number of plants and considerably over one-half of its stations. Another is that some stations have been transferred from the figures for connecting companies into the figures for Bell owned stations through consolidations. Still a third reason is that independently owned companies have not been active in developing new business or have not been able to take the business offered because of lack of facilities.

In all probability each of the three have contributed, but we are inclined to believe that the third cause is the principal cause for the falling behind of the connecting companies. If we are correct in our conclusions, here is a situation to which the managements of locally owned companies may well give attention.

In accepting a monopoly of the telephone business in a community, the telephone company has accepted the obligation of furnishing adequate telephone service to that community. If it fails, either because of lack of effort or because of inadequate plant, to build up the service to the maximum the community requires, it is not doing its share in meeting its obligation.

One of the most frequently

heard complaints against the Bell system in the days before competition was that it could not or would not furnish service; that many people desired service which the company would not install. This alone furnished the impetus for the organization of competing companies in many places. As a result of competition the telephone service of this country has been built up on a basis that anyone who was willing to pay the prescribed rate might have service.

If the telephone industry fails to keep itself on that basis we may look for competition again just as surely as it came in the past. The only difficulty is that the competition this time will not come from other private organizations, but rather from the municipalities themselves. It will come either in the form of competing municipal exchanges or through the forced sale of existing companies either to municipalities or to state or nation-wide government-owned systems.

In spite of the failures to furnish adequate service by government-owned systems in foreign countries, the advocates of government ownership in this country will be quick to seize the opportunity of promoting their projects if the industry fails to keep up to the public demands. Duty to its public and to its own interest demands that every company place itself immediately in the position of being able to provide adequately for the service demands of the communities in which it operates.

PRIVATE BRANCH EXCHANGE DEVELOPMENT

One avenue of development of the telephone business that has been overlooked in many exchanges is the private branch exchange. This is not so much true in the large cities, where private branch exchange terminal stations form very considerable percentages of the total station development, but is very true in most of the smaller industrial communities.

A survey of two small industrial cities, having a total of less than ten thousand population, showed not a single private branch exchange. In these two cities there were at least five manufacturing concerns that could very well have been using private exchanges of from five to upward of twenty-five stations. While not true in these cities, ordinarily the hotel private branch exchange also offers opportunity for development.

It would seem that there is an opportunity for a wide-awake commercial manager to survey his local situation and to sell the idea of private branch exchange service. The income from such service at an adequate rate might make a nice addition to the revenue of the exchange.

MANAGERS WE'VE KNOWN

In one town we have visited, there is a business man who owns the controlling interest in and acts as manager for the telephone company. He got into the telephone business years ago when the doctor, the grocer, the druggist and other local business men formed a company to put in an exchange. He was elected secretary and became the active manager.

In the course of time, changes among the business houses have occurred and this man from time to time has purchased the interests of his former associates. He has continued his personal business and manages the telephone company as a side line.

We said "manages" and will have to stand by our statement because all of the management which the company gets is what he gives. As a matter of fact, it might be said that the plant runs itself. The lineman has been on the job for years, knows every pole and cross arm, every instrument and drop wire, and is practically his own boss. The operators run the switchboard and make collections almost without supervision.

The plant is making no money. No extensions or improvements are being made and things generally are at a standstill. The manager—since we, by courtesy, have called him such—complains of the situation, but does nothing to improve it. Why? Because he has other business and is afraid that a raise in rates and the enforcement of prompt collections will injure the good will of his private business.

In nearby towns there are managers who are operating up-to-date plants and giving good service. Their rates are higher. They must be. These managers must meet continually comparisons between their rates and his rates. "A friend of mine over at X gets his telephone for a dollar a month," say their subscribers. Their business is handicapped to a certain extent because of this.

What can be done about it? We don't know. Perhaps some day this manager will wake up to the fact that the telephone plant, properly managed, has greater earning potentialities even with a return restricted by State Regulation than has the other business in which he is engaged. Perhaps some day, he will have to retire on account of old age or perhaps the plant will fall down and make a change necessary. Until that time, the telephone business in nearby towns will have to suffer because one manager looks upon it as a side line instead of a real business that is worthy of attention and one that deserves the undivided time of a competent manager.

Washington, D. C.—F. C. Brown, Acting Director of the U. S. Bureau of Standards, Washington, D. C., has been appointed a representative of the Department of Commerce on the American Engineering Standards Committee, succeeding S. W. Stratton. E. C. Crittenden, Chief, Electrical Divison of the Bureau, is alternate.

Our Literary Digest
Review of Recent Articles on the Telephone and Allied Subjects

"Public Address Systems," by I. W. Green and J. P. Maxfield. Journal of the American Institute of Electrical Engineers, April, 1923.

"Use of Public Address Systems with Telephone Lines," by W. H. Martin and A. B. Clark. Journal of the American Institute of Electrical Engineers, April, 1923.

These two papers by members of the development and research staffs of the American Telephone & Telegraph Co. and the Western Electric Co. are the first papers to describe technical details of the public address system developed by those companies and used either to amplify the voices of public speakers so that they may be heard by large audiences or for connection with long-distance lines so that audiences in various points may hear a single speaker. The first paper is devoted to the description of the systems themselves, and the second paper to the special problems involved in the transmission of speech or music over telephone lines for reproduction by loud speaking apparatus located at distant points.

It is pointed out in the first paper that a number of acoustic problems had to be solved in connection with the development of the loud speaking system. Four important factors are reverberation, echo, resonance and diffraction. When the pick-up apparatus and the reproducing apparatus are located in the same room, the problem of eliminating singing is also met. In the solution of the problem it was necessary to keep in mind that the reproduced sound must be free from distortion, and also that flexibility of the system required that each component part be free from characteristics that would cause distortion. Curves are given to show the comparative freedom of the system from objectionable distortion.

The "pick-up" transmitters of the condenser and double carbon chamber types are described in detail, as also are the amplifiers and control devices. The reproducing device is a receiver mechanism having a light spring-supported armature, which is connected by a link to the diaphragm, which is made of impregnated cloth, corrugated to permit vibrations of large amplitude. Different types of horns are used to meet the conditions found where the equipment is to be used.

In the second paper the problems of transmission of speech over telephone lines for reproduction are discussed. Distortion is likely to be more serious when the volume is amplified by the reproducing apparatus. For this reason circuits with a high cut-off frequency are required. Non-loaded open-wire circuits and extra-light loaded cable circuits are the best of the ordinary forms of wire circuit. To a considerable extent distortion introduced by a length of non-loaded cable may be corrected by a network called an attenuation equalizer. As the transmitter used at the sending end is associated with amplifiers, attention must be given to an adjustment of the power levels along the line, so that telephone repeaters will not be overloaded and severe cross talk will not be introduced into near-by circuits. A number of typical combinations of loud speaking devices and telephone lines are described, including that used on Armistice Day in 1921, when 100,000 people at Arlington, Va., 35,000 at New York and 20,000 at San Francisco joined in the services at the burial of the Unknown Soldier.

The two papers abstracted here were presented at the Midwinter Convention of the American Institute of Electrical Engineers at New York on February 16, and by use of the system described in them they were heard simultaneously by a meeting at Chicago.

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"Printing Telegraph Systems and Mechanism," by H. H. Harrison. Longmans, Green & Co., New York and London, $7.50.

This is one of the series of "Manuals of Telegraph and Telephone Engineering," published by Longmans, Green & Co., of London. A closely printed book of 429 pages, with over 600 diagrams, it covers the entire field of printing telegraph systems. Starting with elementary considerations of the formation of the different type of telegraphic alphabets, the author draws conclusions as to the general principles of the composition, transmission, reception and translation into typographical characters of printed telegrams. Following the analysis of the processes, the simpler elements of the various mechanisms that may be used to perform them are described. The remainder of the book deals with the various systems in use. Both single channel and multiplex systems are analyzed in detail. The arrangement differs from that of the usual text book in that the author sets forth general principles of operation and then shows how these principles are applied in the different systems. While this method of treatment is excellent from the standpoint of the student who would study the principles so that he might be able to classify a new system and apply the principles to a study of its operation, it brings the author into many difficulties in the arrangement of his book. For instance, the discussion of telegraph transmission is found sandwiched between two descriptions of operating devices. The extremely long chapters with the entire absence of sub-headings makes for some difficulty in locating particular topics. As the book is a valuable reference work as well as an excellent text for study, this is rather unfortunate. In spite of this drawback the book is worthy of a place in the reference library of every telegraph engineer.

One thing that struck the reviewer on reading the statement of the author in his preface that the center of gravity of development in communication is the United States, is that the center of gravity of publication of text books on the communication art seems to have been transferred to England.

"Your Telephone—The Voice of Your Business," by Pauline Dunstan Belden, has been issued by the Blodgett Press, St. Paul, Minn.

This book is intended for distribution among sales organizations and others whose voices are supposed to represent the institutions employing them. The booklet sells for 50 cents a copy, with discounts in quantities. It is an interesting and practical manual for business users of the telephone and undoubtedly will have a big sale, which will be beneficial propaganda for telephone companies.

Commercial News Broadcasting Conducted in Germany

Berlin, Germany. — Approximately 800 banks and industrial institutions are subscribers for the commercial news broadcasting service of the Express Service Co. For the service each subscriber pays 300,000 marks, and for the instrument an annual rental of approximately 200,000 marks. There are two half-hour schedules daily—at 9:30 a. m. and 5 p. m.

Valuation in Rate Making

Chapter XIV—Collateral Costs

By Charles W. McKay, Associate Editor*

In concluding the discussion of Unit Costs—as presented in the February and March and April issues—it will only be necessary to suggest that the "rule of common sense" is a fundamental rule in the preparation of all data pertinent to the unit cost problem. In the discussion, as presented, we have referred to a five-year analysis period—and to be consistent this period has been assumed in connection with all of the illustrations cited. It may be, however, that in certain instances a period longer than five years may be necessary—while under other conditions a shorter analysis period may be justifiable. The length of the period must, of course, be entirely predicated upon a careful consideration of the peculiar conditions existent in the case under analysis.

Regardless of the length of the analysis period, however, it is of utmost importance that all of the data used in compiling the unit costs, should be in readily verifiable form—in view of the fact that the unit cost portion of a valuation is frequently scrutinized, most carefully, by opposing counsel and, usually, by the engineers of the Public Service Commission. In other words, the one who prepares a valuation may be absolutely sure, in his own mind, that all of the figures represent a fair and conservative estimate of the true value of the property. However, for obvious reasons, it is important that all cost data shall be readily susceptible to proof—not only to the one who prepares the valuation—but also to others who may be inclined to assume a more skeptical attitude.

Collateral Costs:

We have now completed our consideration of the value of the inventoriable property. The "inventoriable" property, it will be remembered, comprises that portion of the telephone plant which can be actually inventoried and catalogued and subsequently priced out, using unit costs. In arriving at the total value of the physical property, however, there still remains a most important factor—the collateral construction costs, or "overhead" costs as they are sometimes termed.

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Before taking up a more detailed consideration of the collateral costs, it may be well to present a table which will illustrate the correlation of the collateral costs to the other elements involved in the total rate-base value. Such a table is presented in Fig. 35.

Classification	Reproduction Cost	Present Value
Direct Construction Costs		
Total Inventoriable Property	$.....	$.....
Omissions and Contingencies	.....	.....
Warehouse and Purchasing	.....	.....
Expense during Construction	.....	.....
Tools and Tool Expense during Construction	.....	.....
Contractor's Profit (if any)	.....	.....
Total Direct Construction Costs (including Total Inventoriable Property)	$.....	$.....
Collateral Construction Costs		
General and Legal Expense during Construction	$.....	$.....
Engineering and General Supervision during Construction	.....	.....
Taxes and Insurance during Construction	.....	.....
Interest during Construction	.....	.....
Total Collateral Construction Costs	$.....	$.....
Total Physical Property	$.....	$.....
Total Non-Physical Assets (including Cost of Establishing Business, Cost of Financing, etc.	.....	.....
Grand totals	$.....	$.....

Fig. 35

Referring to Fig. 35—it will be noted that the items, Omissions and Contingencies; Warehouse and Purchasing Expenses and so forth,—are segregated from both the Cost of the Inventoriable Property and the Collateral Construction Costs. Frequently this group of items are included with the collateral construction costs—but on the other hand many valuation engineers prefer to include them with the inventoriable property. It seems to the writer that it is perhaps better to include this group as a part of the total direct construction costs—but to segregate them both from the inventoriable property and the collateral construction costs.

Omissions and Contingencies:

Referring to these items briefly—in the order in which they are presented in Fig. 35—let us first consider what should be included under the caption "Omissions and Contingencies." This item includes both omissions from the inventory and omissions from the unit costs. It is a known fact—and one generally conceded by both courts and commissions—that, no matter how carefully an inventory may be recorded, certain items of plant are bound to be overlooked. For this reason, it is customary to include a small percentage allowance to cover such "omissions." Likewise, in evolving the unit costs, omissions frequently occur due to "contingencies" which have arisen in connection with the actual construction of the plant—but which, for various reasons, are not readily apparent to the appraisal engineer. As an illustration—let us consider the case of a unit cost evolved for a six-duct conduit system, built some ten or more years before the date of appraisal. In evolving the unit cost the valuation engineers may have exercised all possible care in determining the probable construction conditions existent at the time the subway was built. Despite this care, on the part of the appraisal engineers, if the actual history of the construction were available—many unusual conditions might come to light which would have a very real bearing upon the cost of the construction work. It may have been that—at the time the subway was actually constructed—certain isolated strata of rock formations were encountered, necessitating expensive blasting. Obviously, the appraisal engineer (not having an actual historical record of the subway construction) would have no means of knowing of the exact na-

ture of such unusual "contingencies." For reasons, such as the foregoing, it has become customary to add an allowance to the unit costs to provide for such unavoidable omissions directly resultant from "unforeseen contingencies." In many court and commission cases the allowance for the entire item "Omissions and Contingencies" has ranged from three to seven percent.

Warehouse and Purchasing Expense:

While the plant is in process of construction, it is obviously necessary to make definite provision for the storing of materials. In some cases, it is even necessary to build temporary warehouses. Sometimes the allowance for "warehouse and purchasing expense" is computed in detail—but more frequently a percentage allowance is added to the cost of the materials involved. This allowance may range from three to five percent of the total cost of the inventoriable property (or a somewhat larger percentage if applied directly against the materials—exclusive of labor).

Tools and Tool Expense:

During the construction period, obviously, many tools are required in connection with the various construction operations—such as the setting of poles; stringing of wire; placing of aerial cable; installation of conduit systems, etc. As a rule these tools—or at least many of them—are worn out long before the construction work is actually completed. As a matter of fact, one set of tools may be worn out and another set purchased before all of the construction processes are completed. Again, an appreciable expenditure is necessary to maintain the tools in good working condition during the construction period. Both the cost of the tools and the cost of maintaining these tools are, in reality, part and parcel of the actual cost involved in the construction of the telephone property. If any of the construction tools remain, in good working order, at the end of the construction period the value of these tools should be debited from the total appraised value of the property and credited to the proper tool accounts of the operating company.

The item "tools and tool expense during construction" is often estimated in detail—in connection with evaluation for rate purposes. A simpler—and perhaps quite as satisfactory—method is to compute conservative allowances in terms of a percentage of the total reproduction cost of the inventoriable property. This percentage may range from two to five percent.

We have now completed a rather brief discussion of these "intermediate" items. As previously stated, they are frequently included as part of the collateral construction costs—altho, in reality, they are more closely akin to the items included in the appraisement of the inventoriable property. In the June installment, the collateral costs proper—as presented in Fig. 35—will be discussed in some detail.

Utilities Must Have Adequate Rates, Says E. K. Hall

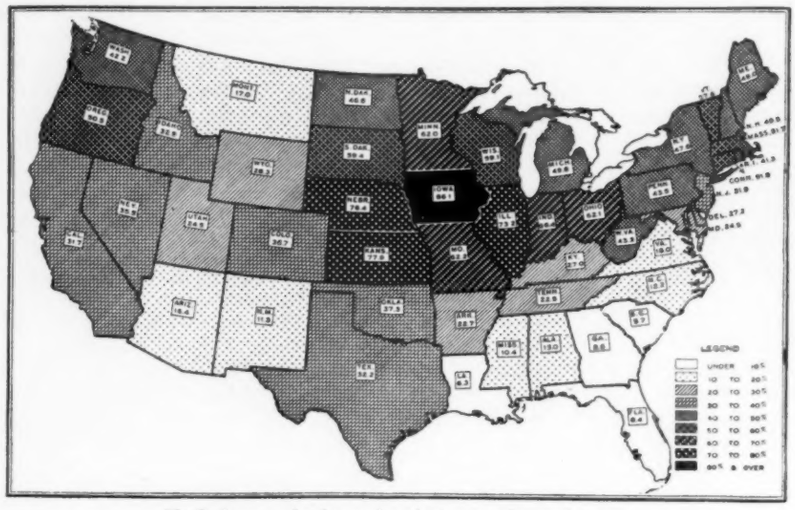
Boston, Mass.—"Public utilities never prosper at the expense of the public, but when they fail to prosper it is always at the expense of the public," declared E. K. Hall, Vice-President of the American Telephone & Telegraph Co., in an address before the Chamber of Commerce here. "Public utilities are your allies," he declared. "You need to have your allies strong and prosperous. Thereby you will get good service today and guarantee good service for tomorrow. Industry can help itself in no better way than by protecting the revenues of its allies. I don't know of a public utility today that can safely reduce its charges. The only mistake that a commission can make is by putting rates too low. Slightly lower rates make very little difference to the consumer, but they can do enormous harm to the public utilities."

To Finance Telephone Lines to South America

New York, N. Y.—New York bankers and the International Tel. & Tel. Co. have practically completed details of the financing of the telephone cable between the United States and South America. "A-pay-as-you-go" policy has been adopted on the financing, which will first care for the West Indies properties. The company plans a development in Latin-American similar to that of the American Tel. & Tel. Co. in the United States. Negotiations also are being conducted with European governments, particularly France, for bringing their systems up to the American standard.

Many Farms in U. S. Still Without Telephones

Washington, D. C.—That the saturation point of telephone development is not reached on the farms of the United States is clearly shown in a recent circular issued by the U. S. Department of Agriculture. The development is shown on the map reproduced on this page. In only one state, Iowa, is the development over 80 per cent, and such well developed states as Indiana, Ohio and Missouri have telephones on less than two-thirds of the farms. South Carolina and Louisiana, with 5.7 and 6.3 per cent, respectively, have the lowest development. The bulletin, which is Farmers' Bulletin No. 1,245, "Farmers' Telephone Companies," discusses the methods of obtaining telephone service, costs of service, etc. Copies may be secured from the department.



U. S. farm telephone development shown by map

Telephone Service for Tampico, Mex., Being Planned

Tampico, Mex.—Installation of a telephone system in Tampico, Mex., seems probable, according to Consul James B. Stewart, of that city. Tampico is one of the largest modern cities at present without telephone service. A committee of the American Chamber of Commerce, working in co-operation with Mexican officials, is engaged in making a house-to-house canvass of the city to ascertain how many telephones will be required and how much capital can be raised from local business men toward financing the project. It is estimated that about $400,000 United States currency will be required, and that half of this amount can be obtained locally. About 3,000 telephones will be necessary to meet the initial demand.

Automatic's Men Keep Climbing

E. K. Blomeyer

O. V. Dodge

W. N. Curtis

N. P. Bartley

BLOMEYER IS BOOSTED

Popular Telephone Man Made a Vice-President of Theodore Gary & Co.

Kansas City, Mo.—Announcement is made by A. F. Adams, President of Theodore Gary & Co., that, on account of the constantly enlarging business of that company, E. C. Blomeyer has been tendered and has accepted a position as a vice-president of Theodore Gary & Co. Mr. Blomeyer, who is a vice-president of the Automatic Electric Co., Chicago, will move to Kansas City and take up his new duties there. By this arrangement, Gary & Co. adds to its present staff of executives another man well known and of long experience in the telephone field. The organization now consists of Theodore Gary, chairman; A. F. Adams, president; H. L. Gary, first vice-president and treasurer; E. C. Blomeyer, C. A. Bennett, H. L. Harris and J. G. Crane, vice-presidents; L. E. Durham, counsel; W. E. Jones, secretary; W. E. Polk, consulting engineer.

E. C. Blomeyer is widely known throughout the field of telephony, not only as a telephone man but as a writer and speaker on telephone affairs. He entered the business in 1904 as local manager for the Southeast Missouri Telephone Co. at Charleston, Mo. He was successively secretary, secretary-treasurer and assistant general manager of that company, leaving it in 1912 to become secretary-treasurer of the Brazos Valley Telegraph & Telephone Co., in Waco, Tex. After the consolidation of this and a number of other companies in Texas into the Texas Telephone Co., he became assistant to the president, and later president of the new company, occupying this position until 1920, when he became connected with the Automatic Electric Co. in Chicago as sales manager, later being made vice-president in charge of sales.

Mr. Blomeyer is author of "Letters to Managers," a series of articles on telephone management, which have had an extensive circulation among telephone people. He also is known as the writer of many articles on telephone subjects, and as the originator of a lecture and charts on utility rate making which have been successfully used by many telephone companies in rate cases. He has been active for years in telephone association affairs, and was for several years president of the Texas Independent Telephone Association. His new connection with Theodore Gary & Co. opens a field of still wider activities and will give him the opportunity of still greater service to the Independent telephone industry.

O. V. Dodge Appointed Sales Manager of Automatic Electric Co.

Effective May 1, O. V. Dodge, for the past nine months purchasing agent for Automatic Electric Co., was appointed sales manager for that company, succeeding E. C. Blomeyer, who goes to Kansas City as vice-president of Theodore Gary & Co. Mr. Dodge came to the Automatic organization late in 1919 and after making a thorough study of the manufacturing processes involved in producing automatic telephone equipment, was assigned to the purchasing department to handle the purchase of raw materials. In January, 1920, he was appointed assistant to the general superintendent, and later assistant to Grant Pelton, vice-president in charge of the factory. During this time, Mr. Dodge also took an active part in the operation of the Monarch Telephone Manufacturing Co., thus being enabled to secure first-hand knowledge of the manufacture of manual telephone equipment. Early in 1921, Mr. Dodge joined Automatic Electric Co.'s sales department as assistant to Mr. Blomeyer, and was delegated certain executive duties in the conduct of that department. In September, 1922, he was appointed purchasing agent. Mr. Dodge comes to his new position thoroughly versed in all departments and activities of Automatic Electric Co., and his experience will, without doubt, be a means of further cementing the friendships existing between that company and its many associates in the telephone field. Mr. Dodge will have associated with him W. N. Curtis, manager contract and foreign sales, and N. P. Bartley, manager P. A. X. sales.

Home Telephone Co. Is Building at Jacksonville, Ala.

Jacksonville, Ala.—The Home Telephone Co., of which R. L. Camp is general manager at 152 S. Main st., Jacksonville, Ala., recently was organized with J. O. Camp, president and secretary. The capital stock is $10,000. This new company will install a Kellogg switchboard and erect two toll lines—one to Anniston, Ala., and one to Piedmont, Ala. They expect to have 200 telephones to connect up by the time their first directory is out. Jacksonville has a population of 2,500 and is the center of a thriving community with two large educational institutions already located there.

NO CO-OP BUYING IN IOWA

Iowa Association Rejects Plan—Economy of Operations Shown at Big Meet

IOWA'S OFFICERS

F. M. Boardman, Nevada, Pres.
E. L. Farwell, Manchester, V. P.
C. C. Deering, Des Moines, Sec.-Treas.

Executive Committee: Fred G. Moore, Washington; Harold L. Beyer, Grinnel; J. M. Plaister, Fort Dodge; O. L. Loudenslager, Le Mars.

Des Moines, Iowa.—Co-operative buying, a subject brought up by the North West Iowa Telephone Assn., was knocked out as a state association matter at the 28th annual convention of the Iowa Independent Telephone Assn. held here.

Financial responsibility falling upon individual members of the association for the entire amount of the purchases was given as a reason for rejection of the proposal. Other ideas submitted by the North West group were turned down after discussion. But the significant fact is that the bunch is "on its toes." The other suggestions were division of the association into plant, traffic, commercial and financial groups, employment of state experts on construction, collections, rates, and financing, and interchange of financial reports among the entire membership of the association.

Success of the association in legislative matters was reported by Secretary Deering, who told that no legislation inimical to telephone interests was put through.

The work of the North West Iowa group was outlined by W. H. Baubendiek.

One of the most interesting practical papers at the meeting was that on maintenance of telephone cables and on locating and clearing cable troubles. Samples of injured cable were shown.

R. H. Holbrook of Iowa State College spoke on industrial Iowa.

How Iowa operates its association thriftily and effectively was outlined by President Plaister. The combination of the office operations of the state association and the Iowa Independent Toll Clearing House was the chief reason given.

"Fundamentals of Americanism," by Senator M. B. Pitt of Crescent, proved to be an illuminating talk on the requirements of good citizenship, and the menaces confronting democratic government today.

The manager as a prominent civic factor was presented in the address of P. M. Ferguson of Mankato, Minn. The ability to pay better salaries, due to increased rates, a proper pride in being known as a telephone company employee and a better public understanding of the telephone company's aims and problems have brought about a happier era in managerial affairs, according to Mr. Ferguson. He advocated a cautious collection policy, and referred to playing on the element of the delinquents' pride in making collections. Personal contact between the management and its employees, and between the company's representatives and the public, also came in for attention in Mr. Ferguson's talk. He stressed the importance of wide distribution of utility securities among its patrons as the strongest protective factor well managed utilities could have.

Joseph Carmichael, director of the Iowa Committee on Public Utility Information, told of the increasing scope and success of this committee's work and recommended stronger advertising to the telephone companies.

A resolution asking the Interstate Commerce Commission to either change the definition of Class C companies to include companies having annual revenues of $25,000 to $50,000, or simplify the accounting requirements of Class C companies, was adopted at the concluding session.

ROCHESTER SETS RECORD

Biggest and Livest New York Meeting Held—Fuller Re-elected Chief

UP-STATE ELECTS

George R. Fuller, Rochester, Pres.
J. G. Ihmsen, Albany, V. P. and G. M.
G. G. W. Green, Johnstown, Secy.
C. M. Beatties, Rochester, Treas.
F. J. Brookman, Rochester, Asst. Secy.

Rochester, N. Y.—With the Rochester Telephone Corp. and the Stromberg-Carlson people as hosts, more than 500 members of the Up-State Telephone Assn. attended that organization's greatest meeting, and went home with memories of an event that was hard to beat from an entertaining and practical standpoint.

Business sessions began with an operators' conference. There were 234 operators in attendance. Miss Lillian Vavasour, traffic inspector for the Friendship (N. Y.) Telephone Co., spoke on the purpose of the conference. Rochester Telephone Co. employees staged a switchboard demonstration. Charles A. Vicker, traffic superintendent of Rochester company, spoke on "Lubricating the Traffic."

F. B. McKinnon, president of the U. S. Independent Association, spoke on the territorial division of properties between the Bell and Independents, and the maintenance of the alignments by just rates. He also referred to the home financing of smaller companies.

John B. Maling's address on "Class and Freak Legislation" was well received.

Advantages of simplified accounting, particularly in rate cases, were cited in the address of Seaborn N. Vines. A plant school was conducted by R. M. Bruce, plant superintendent at Rochester. A practical demonstration of trouble shooting and one on prevention of loss and waste of materials was given.

Frank T. Byrne, commercial superintendent at Rochester, told of the results of an intensive drive for new business and impressed his hearers with the facts that new business always could be had and handled.

A radio lecture, illustrated, was given by Prof. E. F. Potter, who urged that telephone men get the revenue that is due them from this business.

A minstrel show given by employees of the Rochester Telephone Corp., a "movie" at Rochester's main theater, the Eastman, and a trip through the Stromberg-Carlson plant were entertainment features. Stromberg-Carlson was host for the theater party.

J. G. Ihmsen, who has been so largely responsible for the profitable functioning of the association, was presented with a huge cork-screw. The ceremony was made the modern version of the ancient presentation of the "keys to the city."

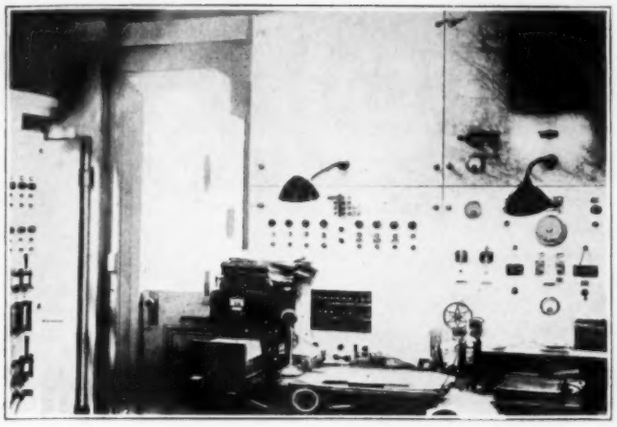
At the last day's morning session the exhibitors were called upon to talk of the products and policies of their companies. The remarks of the sales representatives and the repartee of their audience made the affair brisk and instructive.

The directors were re-elected at the concluding session.

Cambridge, Mass.—Catalogs descriptive of Acme radio transmitting and amplifying apparatus, containing some interesting technical literature on these phases of radio work, have been issued by the Acme Apparatus Co.

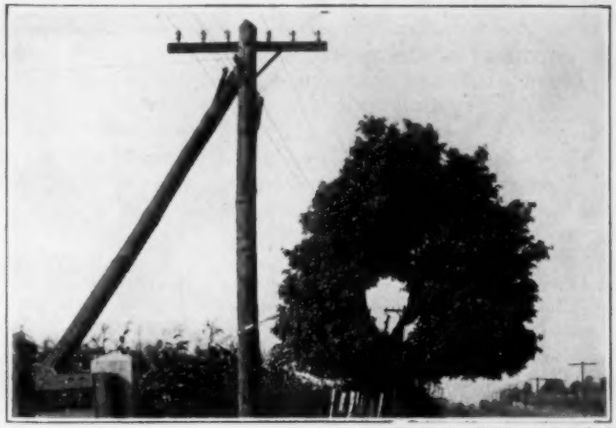
Spokane, Wash.—Seventy-nine miles of toll construction is being installed by the Pacific Telephone and Telegraph Co. on the Spokane-Portland toll line. The cost is to be approximately $222,000.

San Francisco, Cal.—Pacific Telephone and Telegraph Co. has bought four pieces of property for new building work. The price of the real estate was $500,000.



Unique Telephone Safety Device in San Francisco Harbor

San Francisco probably uses ferries more than any other city in the world. The harbor is a maze of ferry slips which the pilot has to learn thoroughly since fogs are frequent. Bells tapping at known intervals are used to indicate the slip and the pilot steers the boat according to its signal. Sometimes the bells get out of order. This is caught promptly by a telephonic device by means of which an operator who knows the signals can always detect any not working properly and electricians on duty rush to fix it



(*Photo by Gilliams Service*)

Tree Forms Unique Link in Telephone System

What is probably the only thing of its kind is a tree on a country road a few miles out of Bloomington, Ill., through which eight telephone wires are strung. Linemen setting up a system were encountered by this tree which the owner refused to allow to be cut down or injured in any way. Finally it was agreed that a hole could be cut through the tree top without in any way injuring the trunk and affecting its vitality and now this extraordinary sight greets motorists who use the highway at this point

Annual Meeting of California Independent Telephone Association

Los Angeles, Cal.—The annual meeting of the California Independent Telephone Association, held here April 28th, was called to order by President Chas. Rolfe, the roll call showing an attendance of twenty, and representing fourteen companies from the Imperial Valley to the San Joaquin. President Rolfe made an oral report of the work of the last year, speaking of the Railroad Commission, the change in its personnel and the assurances that the Telephone Association would co-operate in the solution of any problem if asked. The replies to President Rolfe's circular letter to members concerning the ravages of white ants in poles were interesting and instructive and will be incorporated into a report. The conclusion seemed to be to use "treated" poles only as a preventative of this pest, although even this precaution was found not be absolutely sure. Mr. Snowden, of Huntington Beach Telephone Co., reported that he had read a government report which said that the government would soon make compulsory the treating of poles with preservatives of some sort as an aid in conserving timber. The officers for the ensuing year are:

Pres., Charles A. Rolfe, president Southwestern Home Telephone Co., Redlands; Vice Pres., Carl H. Lorbeer, manager Pomona Valley Telephone Union, Pomona; Treas., P. R. Ferguson, auditor Interstate Telegraph Co., Riverside.

Executive Committee—L. C. Torrance, Jr., vice president Santa Monica Bay Home Telephone Co., Ocean Park; A. Terkel, president and manager, Reedley Tel. Co.; F. H. Wright, secretary and manager, Home Tel. Co., Covina; T. A. Gould, president and manager, Redondo Home Tel. Co.

The attention of member companies again is called to the booklet giving the decision of the Appellate Court of California on the duty of wire utilities in furnishing service to the public and endowing them with a right to trim trees. Address requests for this booklet to Pres. Rolfe at Redlands.

BLIND MAN'S BUFF

Even in this enlightened age some folks spend their money blindly. They buy with their eyes shut—they grope in the dark.

And all the time a powerful light is being thrown on the things they need and want!

Advertising is a beacon to guide you in buying. It shows you what to buy, where to buy and when to buy. It protects you against fraud and inferiority.

Firms which advertise deliberately focus thousands of eyes upon their products. Their values must be honest and their prices right, or they could not advertise successfully.

Don't play blind man's buff with your hard-earned dollars. Spend a few minutes running through the advertisements in this paper. Then buy only those products which can stand the light of advertising.

Celebrate George R. Fuller's 73rd Birthday at Rochester, N. Y.

Rochester, N. Y.—Seventy - three roses—one for each year—were presented to George R. Fuller, president of the Rochester (N. Y.) Telephone Co. at a surprise party given on his 73d birthday here, April 7. The "Hail-to-the-Chief" event was the occasion of much merriment on the part of several hundred employees of the Rochester company and a complete surprise to Mr. Fuller, who is one of the most prominent veterans in independent telephony.

C. M. Niezer Heads Fort Wayne —Frank Bohn Operating Chief

Fort Wayne, Ind.—Chas. M. Niezer, president of the First National Bank of Fort Wayne and prominent in civic affairs, has been elected president of the Home Tel. & Tel. Co. He succeeds W. L. Moellering, who resigned. Mr. Niezer has been a director of the company for more than two years. Frank Bohn was made vice-president and general manager, being placed in complete charge of the operation of the company.

Magneto Service Instructions Issued by Independents

Chicago, Ill.—"Magneto Service Instruction," by Miss Anne Barnes, traveling chief operator of the Iowa Independent Telephone Assn., has been issued by the United States Independent Telephone Assn. for the guidance of the student operator of small exchanges. The price is 15 cents a copy. A booklet on "Long Distance Operating Rules" is to be issued soon by the association.

NEW RADIO REGULATIONS

Department of Commerce Opens Band of Wave Lengths for Broadcasting

Washington, D. C.—The Department of Commerce, Bureau of Navigation, has notified all radio inspectors, owners of broadcasting stations and others that it has accepted the recommendations of the Second National Radio Conference and has taken steps to put the plan into effect as soon as practicable.

The United States is divided into five zones with separate wave lengths designated for certain localities in each zone.

Three classes of broadcasting station licenses will be issued:

Class A—Using power not exceeding 500 watts in the antenna and a wave length between 222 and 300 meters, giving proper protection to ship communication on 300 meters.

Class B—Using power not exceeding 1,000 watts or less than 500 watts in the antenna and a wave length between 300 and 345 meters and 375 and 545 meters. (See regulations covering Class B stations.)

Stations in this class now licensed to use the 400 meters wave length will be assigned the wave length designated for that locality and will not be licensed to continue the use of 400 meters.

Class C—This class covers renewals only of licenses authorizing the use of the 360 meters wave length. New licenses will not be issued to use this wave length. Stations preferring to continue the use of this wave length are to be permitted to do so.

It is proposed to put the reallocation of wave lengths plan into effect at noon May 15, 1923.

Radio inspectors will notify the owners of all licensed Class B stations of the wave length assigned for their locality under the new plan, and advise those stations of this class who are not on 360 meters to make provisions to use the new wave length at the time specified. The new wave length must not be used for broadcasting prior to the date indicated. The use of the 400 meters wave length will not be permitted after May 15, 1923, except by the station to which this specific wave length is assigned under the new plan.

Hereafter all Government reports will be sent on the wave length assigned to the station, and the exclusive use of the 485 meters wave length will be discontinued for this service.

Stations now licensed to use 360 meters (now placed in Class C) have the privilege of transferring to Class A and using a wave length between 222 and 300 meters, which will be designated by the radio inspector, or, if they can qualify, transferring to Class B and using the wave length designated for that locality within the band between 300 and 345 meters and 375 and 545 meters.

Where two or more stations of one class operate in the same city or locality a division of time will be required if necessary.

RADIO IN SUMMER

Bureau of Standards Radio Chief Discusses Possibility of Summer Radio

Washington, D. C.—Radio will be used more extensively during the coming summer than in past summers is the opinion of L. E. Whittemore, alternate chief of the Radio Laboratory, Bureau of Standards. In discussing the subject of summer radio in Radiofax, Mr. Whittemore says, in part:

"Two elements of radio receiving sets which have been perfected during the last year or two have gone far to help in making it convenient and satisfactory to use radio receiving sets outdoors. The first of these is the advent of the dry battery tubes—that is, electron-tube detectors and amplifiers which require only a small dry battery rather than a heavy storage battery to light the filaments. The second improvement is the development of more satisfactory loud speakers which furnish a considerable volume of sound without undesirable distortion. Thus it is possible now with small portable receiving sets, which can be purchased or which can be fairly easily assembled, to receive radio broadcasting while out camping or boating or making automobile tours. It is a noteworthy fact that exploring parties now take radio receiving sets with them for the dual purpose of furnishing amusement during the evening hours at camp and for receiving time signals with which to check their chronometers.

"It must be conceded that transmission conditions are not as good in the summer time as in the winter. But this need not interfere with good reception from local stations. About nine-tenths of the area of the country and probably 95 per cent of the population is within one hundred miles of a broadcasting station which furnishes an excellent service. Therefore, while it has been possible during the winter to receive from any one of a large number of broadcasting stations, the summer decrease in transmission range will mean not an entire stopping of broadcast service for large numbers of people, but only a decrease in the number of stations between whose service they can choose."

RADIO TIES TELEPHONES

Stunt by Radio Fan Ties Up Service Till Company Gets Busy

Sherman, Tex.—Radio fans here recently discovered a new way to get broadcasting service, but the results were so disastrous to telephone service that the telephone company found it necessary to put a stop to the practice. C. A. Shock, vice-president of the Grayson Telephone Co., in a recent letter to TELEPHONE ENGINEER, describes the stunt used by one of his subscribers. Mr. Shock's letter says, in part: "He arranged a connection whereby he could switch the radio to his residence telephone line, and informed some of his friends about the city that if they would call 'Central' and ask her to connect them with 800, they could 'listen in.' Of course these friends told their friends, and they likewise began to ask to be connected with 800. The operators told us of what was being done, and we kept an eye on developments. After a time complaints from subscribers began to come to the effect that they had tried in vain to get certain subscribers, being told repeatedly by the operator that the line was busy. We were soon able to trace the cause of these complaints to the radio, and issued an order to the effect that no radio connection should be made before 9 p. m. This was taken as a license for everybody to call in after 9 p. m. and get connected. We soon found that we had an overload on our battery and that the service was being greatly interfered with, as folks who called others after 9 p. m. usually did so because of some important matter, and when they were told that the line was busy it caused more trouble.

"The climax was finally reached on a certain night, when I investigated and found 201 telephones connected with number 800. The following day an order was issued that no more such connections should be made, and it seemed for awhile that our troubles before issuing the order were mild compared with what the enraged radio fans had to say over being cut off from their favorite pastime. We succeeded, however, in getting our proposition fairly before them and have had no further trouble."

Rate Standardization Bulletin Issued by Ohio University

Readers interested in the series of articles which we recently published on "Standardization of Telephone Rates" now can get the complete bulletin of the Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Practical Plant Problems

Chapter XIV—Review of Engineering Practice

By Charles W. McKay, Associate Editor*

In the residential section of the larger towns and cities, telephone companies are frequently called upon to meet unusual conditions in providing distribution facilities. This is due to the fact that the property owners, quite naturally, wish to eliminate—insofar as possible—the unsightly conditions resultant from the installation of the ordinary pole and wire, or aerial cable, type of distribution plant.

Many of the cases falling under the category above described, arise in connection with the wholesale development of real estate projects. The writer recalls an instance where a large real estate development company strenuously objected to the installation of the ordinary type of telephone distribution facilities—due to the fact that this company was spending a large amount of money on a high-class type of real estate "improvement." In this particular case the company built the houses and subsequently sold them to the ultimate individual owners. All of the houses were of concrete—or of some form of exterior construction closely akin to concrete, such as stucco and so forth—and the real estate company had adopted the appellation of "The Concrete City" as applied to their property. The writer had occasion to deal with the owners of the property with respect to the telephone facilities, and at first they were inclined to insist that the telephone company install a complete underground system throughout the entire property. The executives of the real estate company had absolutely no conception of what such an underground distribution system consisted—nor the cost of installing such a system. The writer designed an underground distribution system that provided for the placing of all wires and cables (even the drop wires to the subscribers' premises) underground. After preparing an estimate of the cost of such a system—and acting in behalf of the telephone company—the writer suggested that the real estate development company pay the difference in cost between an ordinary telephone distribution system and the elaborate underground system. The real estate company quite naturally demurred to this suggestion and asked if some compromise could not be effected. In behalf of the telephone company the writer suggested the use of reinforced concrete poles (placed along rear property lines)—thus carrying out the "Concrete City" idea, as exploited by the development company. In view of the fact that the telephone company wished to make a practical test of the life and general utilitarian value of concrete poles—it agreed to stand a little more of the cost than the amount represented by the difference between the cost of the concrete type of installation and an ordinary distribution system. This plan proved acceptable to the development company and, as a result, short concrete poles were designed for installation in the interior of each city block.

The original plan provided for the installation of 17 ft. poles, 5 ft. in the ground and 12 ft. out of the ground, but after talking the matter over with the local electric light company, it was found that they—the electric light company—were only too glad to enter into a joint pole agreement. The poles as ultimately installed, therefore, were 21 ft. poles (5 ft. in the ground and 16 ft. out of the ground). The upper portion of the poles was used exclusively by the electric light company; a 4 ft. clearance was provided and the telephone cables were placed at a height of 12 ft. above the ground. The existing specifications for joint pole use (by electric light and telephone companies) were strictly adhered to. These specifications called for the placing of a short "guard arm" parallel to—and immediately over—the cable at each terminal pole. All other requirements—embodied in the joint-use specification, were strictly adhered to. The joint use of poles by electric light and telephone companies will be discussed in detail in a subsequent installment—so that we will only refer to that phase of the subject here, which has to do, specifically, with the problem under discussion.

In connection with this particular installation, it may be further said that the concrete poles were so moulded as to provide a slight "bevel" at the corners. The reason for this was three-fold. The bevelled pole presented a more sightly appearance; it did away with sharp corners, which might be an objectionable feature to many of the development company's prospective purchasers (especially those having children), and furthermore, it minimized the possibility of "cracking" at the corners.

This plan, while expensive, worked out very satisfactorily. Where the cables were laid from one block to another it was, of course, necessary to provide a conduit under the street. Unless the cables between blocks were of relatively large size, it was not necessary, however, to provide manholes.

Another type of distribution which has been used in some sections of suburban New York, provides for a complete underground system. The particular installation the writer has in mind, was paid for entirely by the property owners and was installed at their specific request. Briefly described, it provided for a 3 inch (internal diameter) conduit between terminal locations. At the terminal locations a small cast iron "hand" or "pull" box was installed. Near these hand boxes were placed, especially designed, cast iron upright columns. Between the hand box and the column, a 1½ inch (internal diameter) was placed. The cables were spliced in the hand boxes and the terminal "legs" were led thru the 1½ inch pipes to the terminal posts. These posts, as previously stated, were specially designed and were provided with a removable water-proof cap at the top. The terminal cable "legs" "fanned out" and terminated on the ordinary type of 11 or 16 pair terminal strips, mounted near the top of the post. The cover, when in place, of course covered the terminal strips in such a way that they were absolutely water-proof. The interior of the cast iron column was hollow and from the base of the column 1 inch (internal diameter) pipes were laid to the individual subscribers' premises. Thru these 1 inch pipes No. 17 gauge copper clad steel, triple braided rubber insulated drop wires were laid from the terminal to the

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individual subscribers' premises. The 1 inch pipes from the terminals to the subscribers' premises were so placed as to have a slightly lower level at the point where they entered the subscribers' premises than at the terminal post. Thus, if any moisture accumulated in the pipes a natural means would be provided for drainage. There was absolutely no danger of flooding the cellars at the subscribers' premises, due to the fact that the terminals were practically moisture-proof.

The plan above described proved very satisfactory from the standpoint of the telephone company—in view of the fact that the property owners bore the original cost of installation, and furthermore, the system was so designed that the possibility of "line trouble" was practically obviated.

Not many telephone companies are forced to face conditions so peculiar as those described in the foregoing illustrations. However, it is well to know that there are ways of overcoming seemingly insurmountable obstacles in connection with the solution of the distribution problem.

Still another plan which has been used—and with most satisfactory results—contemplates the use of "octagonal" sawed poles—instead of the ordinary round poles. The height of these poles, of course, depends upon whether they are to be used jointly with the electric light company or solely by the telephone company. If joint use is contemplated, the poles should be 21 ft. (over all length)—otherwise 17 ft. (over all length).

In specifying these 21 and 17 ft. over all lengths, it will, of course, be understood that the poles are to be used in city blocks which are not bi-sected (longtitudinally) by alley ways. If the city blocks are so laid out as to provide alley-ways, it is of course necessary to use higher poles in order to provide a proper clearance for vehicles traversing the alley-ways.

New E. M. F. Electrical Year Book Is Out

The second annual edition of the "EMF Electrical Year Book" has just been issued by the Electrical Trade Publishing Co., Chicago, Ill. It is a completely revised and enlarged reference book, which combines in one volume a dictionary, encyclopedia and trade directory of the entire electrical industry. There are several hundred topics dealing with telephone practice and telephone equipment. These were prepared by Mr. Arthur Bessey Smith, chief research engineer of the Automatic Electric Co. The new book is a large, well-bound volume (9 by 12 ins.) of 1,230 pages, of which 1,030 constitute the alphabetical text. The book sells for $10.

POLE TREATMENTS

Committee of Wood Preservers' Association Reports on Pressure Treatments

The report of the Committee on Pressure Treatments of Poles to the American Wood - Preservers' Assn. gives some interesting data on results of these treatments in certain pole lines. A portion of the report is as follows:

"(a) American Telephone and Telegraph Co., Washington-Norfolk Line.

"Details of the results of an inspection made in 1914 of the poles in this line are described in a paper by F. L. Rhodes and R. F. Hosford, published in the 'Transactions of the American Institute of Electrical Engineers' for the year 1915. Briefly stated, out of 1,614 poles inspected, 1,467 were still sound. A partial inspection made in 1921 of this line showed a condition which indicates that the A. T. & T. Co.'s previous estimate of thirty years for the life of the creosoted pine poles in this line is conservative.

"(b) American Telephone & Telegraph Co., Montgomery-New Orleans Line.

"Details of the results of an inspection made in 1915 of the poles in this line are described in the paper by Rhodes and Hosford referred to above. Briefly stated, out of 1,558 poles inspected, 1,049 were still sound. An inspection made in 1921 of this line affords no reason for changing the telephone company's previous estimate of approximately twenty-five years for the life of creosoted pine poles in this line.

"(c) American Telephone & Telegraph Co., Birmingham-New Orleans Line.

"An inspection was made of this line in 1921.

"(d) American Telephone & Telegraph Co., Charleston - Montgomery Line.

"No inspection made.

"The details of the results of recent inspections of the above mentioned lines will be published in due course through the American Institute of Electrical Engineers.

"The life histories and additional information on other full cell lines listed in 1922 report is being collected, but is not available for this report.

"Following full cell line is listed for examination as opportunity offers, as its general location and setting is different from any line previously listed:

"Chicago, Lake Shore & South Bend Railway Co.

"Chicago-South Bend Transmission Line.

"General:

"This line extends from Kensington, Ill., to South Bend, Ind., and was constructed in 1907 and 1908. There were installed approximately 2,400 45-foot and 50-foot southern yellow pine poles, treated under pressure with creosote; 1,290 45-foot poles were furnished by the Southern Creosoting Co. of Slidell, La. The remainder were furnished to them by the L. & N. Railway plant at West Pascagoula, Miss.

"Treatment:

"The specifications under which these poles were treated requires 12 pounds of oil per cubic foot, Bethel process. However, the specifications require that the amount of oil injected into these poles was to be calculated on the exact contract size of the pole and not on the actual dimensions; therefore, the actual cubical contents of these poles were all figured on the basis that every pole had a 9½-inch tip and a 14-inch butt. No doubt a very large percentage of them were considerably larger than these dimensions and the poles thus received less oil than specified above.

"The creosote oil used in the treatment of these poles conformed to grade No. 1 creosote oil specification and was obtained from England. They were treated in the following manner:

"Steamed—6 hours at 30 pounds, 274° F.

"Vacuum—4 hours at 26 inches.

"Oil Pressure—½ to 1 hour, 60 to 90 pounds pressure.

"Character of Timber:

"The contractor furnishing these poles agreed that the total number of loblolly pine poles furnished shall not exceed 40 per cent, the remainder to be long-leaf pine.

"Location and Setting Conditions:

"The history of this line is presented as the setting conditions differ from other lines set forth in previous committee reports. This line runs through a slightly rolling country. Between New Carlisle and South Bend there is sandy clay and black loam soil. Between Kensington and Hammond there is black muck; Hammond to New Carlisle, sand.

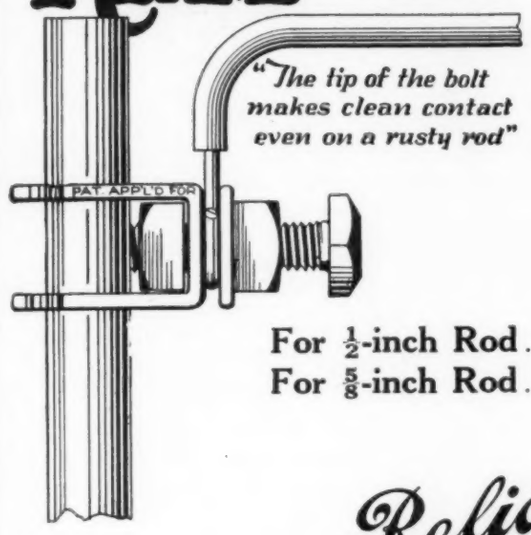
"Poles are set in concrete, which envelops the entire butt to approximately 6 inches above the ground line.

"Details as to the condition of the line are lacking."

Bell Pioneers to Meet October 19-20, at Atlantic City

New York, N. Y.—L. H. Kinnard, president of the Telephone Pioneers of America, has announced that the 1923 annual meeting and the second meeting of the General Assembly of the organization will be held at Atlantic City, N. J., October 19 and 20. Special trains are planned. Details of the program, transportation, hotels, etc., will be announced later.

KLING KLAMP FOR GROUND RODS



WHY *MONKEY* WITH SOLDERED RODS?

For ½-inch Rod.....15c each
For ⅝-inch Rod.....18c each

Quantity Discounts
100 lots—10%
1000 lots—20%

Reliable Electric Company

3145 Carroll Avenue, CHICAGO, U. S. A.

TELEPHONE APPARATUS (QQ-30-21)

The Telephone Receiver

RECEIVER ELEMENTS CONTINUED

The first component KH^2 is the constant pull of the permanent magnets, and therefore has no effect on the vibration amplitude of the diaphragm. Its only effect is to place the metal of the diaphragm under constant tension, and to give a constant "set" or curvature to the metal. The second term, Kh^2, is proportional to the square of the magnetic field produced by the electromagnet, and as before explained, causes diaphragm vibration proportional to the square of the current and hence distortion at extreme frequency rates. The third term or component $2KHh$ involves both the strength of the permanent and electromagnetic fields (H and h), and as this is a first power expression, the effect is proportional to the current intensity and therefore acts without causing distortion. From the latter we see that the amplitude of vibration depends on both (H) and (h), hence the greater the strength of the permanent magnetic field (H), the greater will be the amplitude of vibration and sensitivity of the receiver. This at once explains why the usual method of employing a permanent magnetic polarizing field causes greater sensitivity than a simple unpolarized electromagnetic field.

Advantage is taken of this relation in the construction of loud speakers, where the intensity of the constant field (H) is increased above that obtained in ordinary headsets by employing electromagnets for the constant field instead of permanent magnets. Instead of the more usual permanent horseshoe magnet, the field of a loud speaker consists of a very powerful separately excited electromagnet, which gives comparatively great values to (H).

In regard to the actuating field (h), the amplitude is proportional to the ampere-turns on the electromagnet coils, thus if (i) is the value of the received current and (n) is the number of turns around the poles, then the actuating field strength is proportional to the ampere turns or to

$$h = in$$

For a given field strength (h), and a controlling value of the received current (i), we must proportion the number of turns according to

$$n = h/i$$

With comparatively large currents (i) the number of turns (n) may be comparatively small, while with very feeble currents the turns must be proportionately increased. Under ordinary operating conditions in telephony the currents are comparatively large and the turns can be made small in number, but in radio reception where the resistance of the vacuum tube circuit may be 10,000 ohms or more, the currents are very small and demand a far greater number of turns. As very fine wire must be used for the winding, owing to the small space available, the resistance of radio phones will run from 2,000 to 3,600 ohms, a figure far greater than common in ordinary telephone. Much depends upon the resistance of the circuit in which the phones are used, unless the phones are operated in connection with a telephone transformer or induction coil by which the current can be proportioned to the resistance of the phones. High resistance phones (Many turns of wire) can be used on low resistance circuits, or low resistance phones (Few turns of wire) can be used on high resistance circuits by employing a telephone induction coil or transformer with the phones in the secondary circuit of the transformer. The transformer ratio can be so arranged that a heavy secondary current is developed for low resistance phones or vice versa, it being understood that the term "resistance" used in connection with the phones indicates the number of turns on the magnets rather than the absolute resistance of the phones.

(Continued from page 23)

question arose: what can we insist on their doing?

"Then we hit on this idea. If we can't insist that employees 'sell' stock we can ask every employee to call on ten people within ten days and tell them the ten points about our stock. And not only can we ask them to do this, but we can insist on it.

"To repeat: we couldn't insist on their 'selling stock'—an impossibility, they thought. We could insist on their 'seeing ten people.' Something, they had to admit, was well within their power.

"By this 'ten-point' idea we set up machinery that would produce orders providede the prospects were virtually sold before the employees called.

"Of course there was one logical way to do this preliminary selling, and that was through advertising.

How Campaign Is Planned

"Before we start a campaign we take big space in all the papers. My own personal policy is to say nothing about the security through this preliminary campaign, but to run some general advertisements about the company and about customer ownership. In each advertisement I try to get attention stirred up over a letter that will be sent to all customers on some certain date.

"In this letter I get right down to cases and try to sell the security.

"I might mention that as soon as the sale opens we begin a series of daily advertisements in large space that get right down to cases and attempt to sell the stock. These continue until the sale ends.

"The sales campaign runs like this:

"1. The general publicity advertisements.

"2. A letter mailed out to all customers.

"3. Meetings of employees. At each meeting I make employees admit that it is entirely within their powers to 'see ten people in ten days and tell them ten points about the security.' I pledge them to do this. I require every employee to give me, on cards, the names of the ten people they agree to call on.

"4. To the names turned in by the employees we send a good mailing piece, which is another stout effort to sell the proposition.

"5. The cards are then turned back to the employees, so that they will have a record of the people they have agreed to see. They are told that, as soon as they have called on a prospect, they must mark the card 'called' and turn it back to their immediate superior.

"6. The general superintendent gets a daily report of the calls made. That gives him a chance to bear down on his subordinates. They in turn get reports from their subordinates and so down to the workers. Each day the general superintendent knows how many calls have been made in each district, and can put pressure on the laggards. Note that, under the old plan, he could not bear down on anybody to 'sell stock,' but he has a perfect right to bear down on a man who has agreed to make calls.

"If the advertising is even half well done—and of course it will be observed that the advertising is the backbone of the whole idea—I have never known this plan to fail."

The ten points that it is insisted the employees tell about the stock consist of ten carefully thought out sales arguments forming a standardized sales talk. The third point of the ten, concerning the safety of the stock, has seven sub-headings. Many of them have a definite appeal to local pride.

Thus the ten-point plan of having each employee call on ten people in ten days with a standardized sales talk of ten points, assures the company that its advertising will be followed up by thousands of personal calls, and that these sales efforts will tie up closely with the arguments used in the newspaper copy and the other forms of consumer advertising.

A list of well thought out "sales openings" is furnished each employee who operates on the ten-point plan. It is suggested that he use the opening which seems best to fit his prospect under the local sentences before starting his standardized sales talk.

The employee salesmen is also given a list of suggestions on "how to close the talk and get the order" for use after his ten points. "The one big rule in this," says the company, "is not to ask the prospect if he wants to buy. That makes it too easy to say no. Don't give him a chance to say no. Ask him, 'Would you prefer to pay cash or would you rather buy on divided payments?' Or, 'Can you handle the stock at once or would you prefer it for delivery on the first of next month?' Or, 'Can you handle ten shares now or would five be enough?'

"If you get a favorable answer to any of your closing questions, bring out the order blank, fill in the date and amount of stock and pass it to the prospect, but don't ask him to sign. Say instead, 'Please put your name here just as you want it to appear on the certificate.'"

"Don'ts" for Employees

In order to control the actions of the men new to selling still more thoroughly, the following list of "Don'ts" is handed each:

"Don't make any representations about the stock that are not contained in this book, published in the house-organ, or told you by company officials.

"Don't guess at answers to questions. It is no disgrace not to know everything. If you are stuck, admit it, and say you will get the information.

"Don't tell anyone, unless they ask you, that you get a commission for selling the stock, or anything about the prizes or the office machinery of the sale.

"In Heaven's name, don't ask anybody to buy 'to help you out' or because 'the company wants to sell some stock.' Make people understand that they are fortunate to get an opportunity to buy a part ownership in the company and to put their money at work building Maine.

"Don't tell anyone, 'If you buy, buy from me.' If you can't sell them, leave them so somebody else can.

"Don't guess that a man can only buy one share. Start talking ten, twenty or fifty shares. It is easier to come down than to go up.

"Don't exaggerate. Don't argue. Don't knock."

I was interested in discovering how much stock men absolutely new to selling might be expected to sell if they called on 25 per cent of the people in a new town. I was informed that "The amount that any company can hope to sell to its customers in any one campaign varies greatly, of course, according to conditions. Experience indicates that the amount which can be sold ranges from one share to eight customers to one share to forty customers, per campaign; or figuring another way, that each employee, on an average, can be counted on to sell from two to twelve shares in a campaign.

The rate of payments to employees for sales varies somewhat. Many commission schedules are based on a flat sale commission of from 50 cents to $2 per share, with bonuses for specially meritorious work during given periods. Other companies employ a sliding scale schedule as follows:

Two dollars for the first ten shares; $1 for the next ten shares; $1 for the next ten shares; 50 cents for the next ten shares; 25 cents for all above.

This graduation applies to sales to one customer. Other companies have adopted the plan paying $1.50 to $2 per share straight commission, with a premium of 25 cents to 50 cents a share for each new stockholder secured.

Most companies pay more for a few shares of stock sold per customer, thus placing a premium on new stockholders. When it is considered that a company with 3,000 employees can, under the low average of ten shares per employee, raise three millions of dollars in a short drive at a surprisingly low selling cost, it is easy to understand the growth in the employee-sales method of getting customers to help finance business.

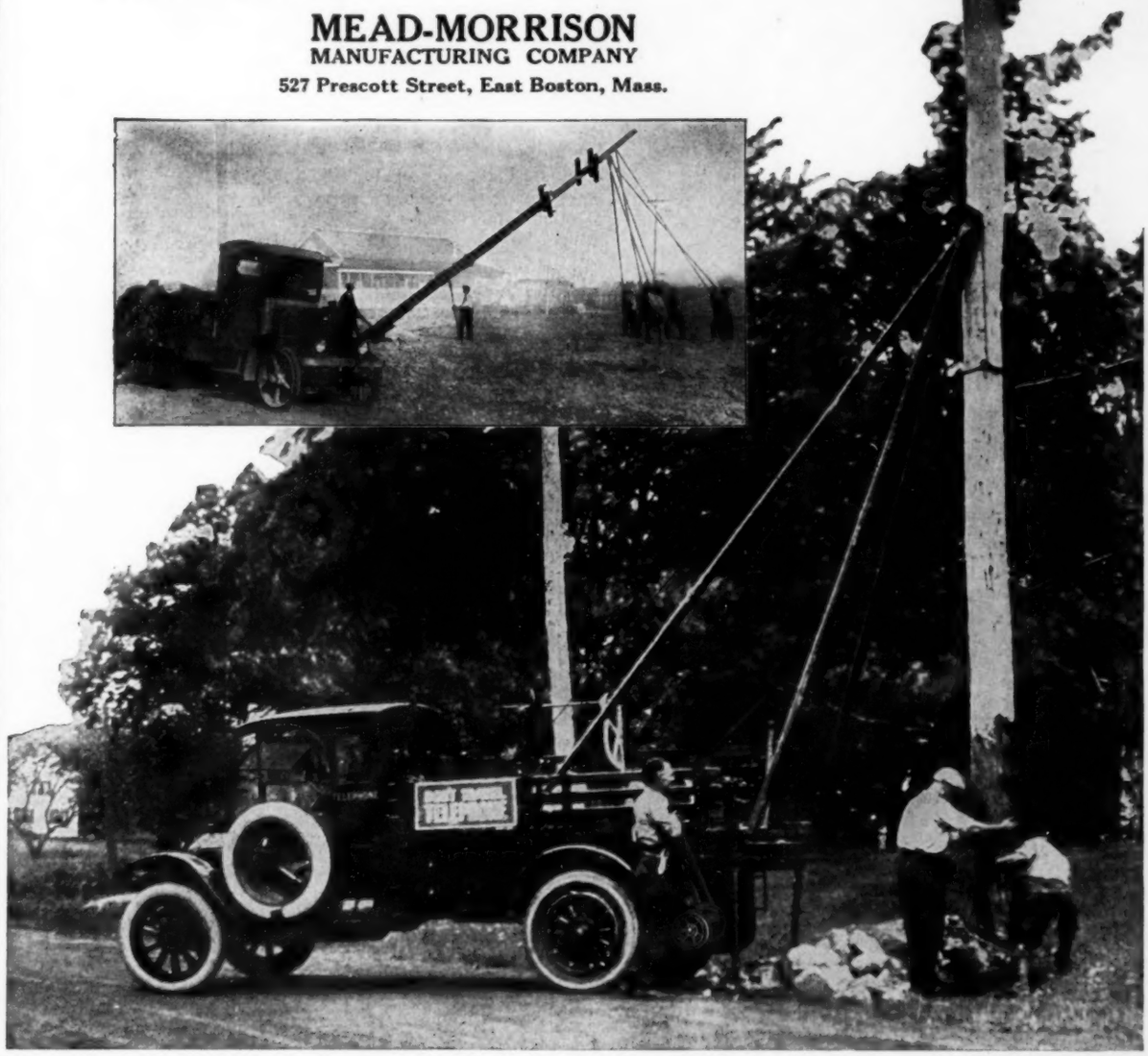
Three Men And A Mead-Morrison Underslung Winch

has proven the ideal combination for telephone work. The Mead-Morrison Underslung Winch allows the use of a light, fast truck. This saves time in getting to and from the job. The winch is out of the way of the load—providing ample body room for the necessary reels and equipment.

The cast steel niggerheads pull underground and aerial, assuring the laying of 50% more underground cable than any other method. The drum loads reels and handles poles.

The Mead-Morrison line also includes capstan winches, both vertical and horizontal, and drums for installation behind the cab. Write for full information.

MEAD-MORRISON
MANUFACTURING COMPANY
527 Prescott Street, East Boston, Mass.



Telephone Talks
No. 4

Life of Dry Cells

GETTING life from a dry cell is not the perplexing problem that the prisoner faces before a jury. However, the verdict one arrives at in determining the life's service to be expected from a dry cell might be just or unjust according to factors given consideration.

Surely no more important factor can be considered than the ability of the cell to remain inactive with least deterioration. Especially in telephone service is this true.

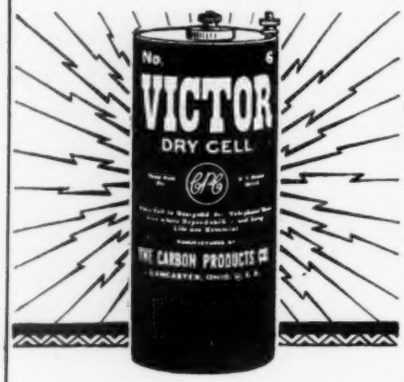
Victor Dry Cells show an extremely small and gradual curve of deterioration in shelf life. Special ingredients have been added to the mixture to offset as much as possible the slow chemical action that otherwise weakens the cell when idle.

The result is a surprisingly long drawn out shelf-life. The critical point of decline is noticeable long after other cells begin to drop sharply in amperage and voltage.

Victors maintain this service life more securely due to the extra reserve strength characterized by rapid recuperation after each closed-circuit period.

The higher voltage also plays a part.

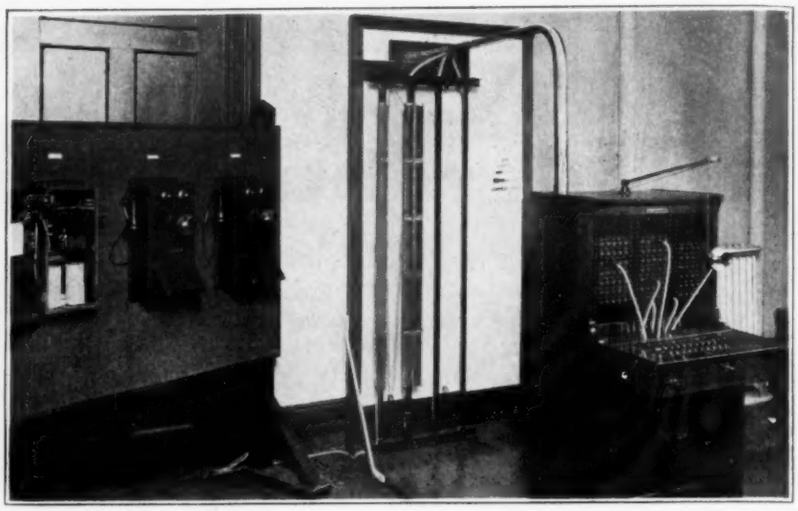
Prove it to your own satisfaction.



THE CARBON PRODUCTS CO.
LANCASTER, OHIO
DISTRICT OFFICES:
105 West Monroe St.
Chicago, Ill.
11-19 Moore St.
New York, N. Y.
706 So. Second St.
Philadelphia, Pa.
Plymouth Bldg.
Minneapolis, Minn.
1001 Main St.
Dallas, Texas

Manufacturers of
Ace Wireless "B" Batteries, Ace Dry Cells, Ace Flashlights and Flashlight Batteries, Victor Telephone Cells, Ace Welding Carbon, Dickey Projector Carbon, Ace Carbon Brushes.

Part of Stromberg-Carlson's Rochester Display



Magneto Switchboard Attracts New York State Delegates

Rochester, N. Y.—One of the attractions at the recent convention of the Up-State Telephone Association, which was held at the Powers Hotel, Rochester, N. Y., was the Stromberg-Carlson exhibit. The exhibit occupied two rooms. The popular room with the delegates was the one which contained the central energy Super-Service switchboard, however, the adjoining room which contained the Stromberg-Carlson No. 105 magneto switchboard and the magneto telephones received unusual attention from owners of magneto equipment. What particularly interested those owners of magneto exchange equipment was the supervisory features offered by the No. 105 switchboard. Such as: The automatically restored ring-off signals, the double supervision and the location of the ring-off signals down on the keyboard in plain view of the operator, says Stromberg-Carlson.

George Rodormer, Reliable Sales Chief, Recovering

Chicago, Ill.—George Rodormer, secretary and sales manager of the Reliable Electric Co., was successfully operated on for appendicitis in an Evanston, Ill., hospital, following his return from the Up-state Telephone Assn. convention at Rochester. He is expected back on the job in the very near future.

Best class of New York groceries receive 60 per cent of their orders over the telephone. "Corner groceries" take from 40 per cent to 42 per cent of their orders telephonically in New York.

Fayetteville, N. Y.—Caroline T. and T. Co. is to spend $500,000 in extensions.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of Telephone Engineer, published monthly at Chicago, Ill., for April 1, 1923.

State of Illinois, County of Cook, ss.

Before me, a notary public, in and for the state and county aforesaid, personally appeared W. H. Graffis, who, having been duly sworn according to law, deposes and says that he is the general manager of Telephone Engineer and that the following is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, general manager and business manager are:

Publisher, Telephone Engineer, Chicago, Ill.
Editor, Herbert Graffis, Chicago, Ill.
General Manager, W. H. Graffis, Chicago, Ill.
Business Manager, H. Graffis, Chicago, Ill.

2. That the owners are (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders, owning or holding one percent or more of the total amount of stock):

W. H. Graffis, Herbert Graffis and Jos. M. Graffis, all of 28 E. Jackson Blvd., Chicago, Ill.

3. That the known bondholders, mortgagees and other security holders owning or holding one percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state).

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full known and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date above is..... (This information is required from daily publications only.)

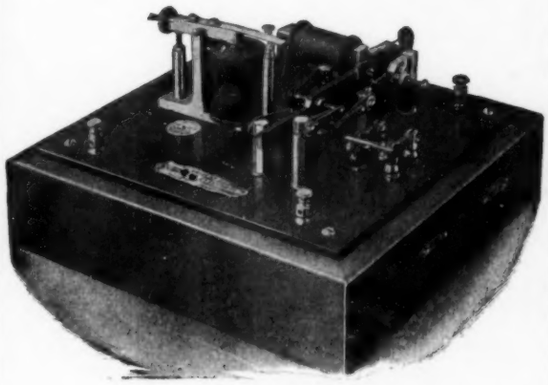
TELEPHONE ENGINEER,
W. H. Graffis, Gen. Mgr.

Sworn to and subscribed before me this 22d day of March, 1923.

(Seal) C. A. LE ROY.

(My commission expires Oct 4, 1926.)

Warner Pole Changer



AN EVER DEPENDABLE SOURCE OF SERVICE—

—the kind of service that is satisfying 25,000 users. Isn't this what you want?

WARNER ELEC. COMPANY
MUNCIE IND.

"INDIANA"
TELEPHONE AND TELEGRAPH WIRE

PROVEN BEST BY TEST

Time and the aid of America's foremost engineers, have enabled us to develop and manufacture the highest grade wire known to the trade. It is greatest in conductivity and lasting qualities, due to the superior quality of material from which it is made, as well as its *Extra Double Galvanizing*, which insures longest life.

STEEL STRAND

Single and Double Galvanized, Standard, Siemens-Martin, High Strength and Extra High Strength Grades.

HANDLED BY MOST JOBBERS

MANUFACTURED BY
INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

THIMBLEYE

DROPFORGED

The Never-Creep Is the Super-Anchor

The name Never-Creep has come to be associated instantly with the best in anchor construction and service.

No big pit is necessary when it is used—no channel has to be cut—there's no creeping whatsoever. Rod is dip galvanized and the plate malleable treated with asphaltum.

Just bore a hole at right angles to the line of pull. Drive the rod through the solid earth into the hole, pass the plate down into the hole and hang over the rod. Simple, isn't it? But how it holds!

The Thimbleye rod is exceptionally noteworthy—saves the cost of a thimble and time and trouble of pulling a guy through the thimble.

Spring is here. Get our latest price list for your construction work.

CHANCE COMPANY
CENTRALIA MISSOURI

NEVER CREEP
THE NEVER CREEP CANNOT CREEP IT PULLS AGAINST THE SOLID UNDISTURBED EARTH
ALL DISTURBED AND MOISTURE EFFECTED EARTH IS BACK OF THE NEVER CREEP

STANDARD SCREWS (BB-10-24)

Properties of Standard Screws

TWIST DRILL GAGES. The actual diameters in inches for the same gage number of drills and steel wire differ considerably and must not be confused. The gage number indicates nothing unless the name of the gage is also included. For this reason, ordering drills by gage number should be discouraged and the drills should be specified by the diameter in decimals of an inch. There are three principal commercial standards for drills and steel wire at the present time, the Stubs steel wire gage, the Standard Tool gage, and the Manufacturers' Standard gage such as is used by the Brown and Sharpe Co., Morse Twist Drill Co., etc. Neither the Stubs gage nor the Standard Tool Co. gage are much used at the present time.

MANUFACTURERS' STANDARD TWIST DRILL GAGE

Gage No.	Diam. Inches	Gage No.	Diam. Inches	Gage No.	Diam. Inches	Gage No.	Diam. Inches
1	0.2280	21	0.1590	41	0.0960	61	0.0390
2	0.2210	22	0.1570	42	0.0935	62	0.0380
3	0.2130	23	0.1540	43	0.0890	63	0.0370
4	0.2090	24	0.1520	44	0.0860	64	0.0360
5	0.2055	25	0.1495	45	0.0820	65	0.0350
6	0.2040	26	0.1470	46	0.0810	66	0.0330
7	0.2010	27	0.1440	47	0.0785	67	0.0320
8	0.1990	28	0.1405	48	0.0760	68	0.0310
9	0.1960	29	0.1360	49	0,0730	69	0.0292
10	0.1935	30	0.1285	50	0.0700	70	0.0280
11	0.1910	31	0.1200	51	0.0670	71	0.0260
12	0.1890	32	0.1160	52	0.0635	72	0.0250
13	0.1850	33	0.1130	53	0.0595	73	0.0240
14	0.1820	34	0.1110	54	0.0550	74	0.0225
15	0.1800	35	0.1100	55	0.0520	75	0.0210
16	0.1770	36	0.1065	56	0.0465	76	0.0200
17	0.1730	37	0.1040	57	0.0430	77	0.0180
18	0.1695	38	0.1015	58	0.0420	78	0.0160
19	0.1660	39	0.0995	59	0.0410	79	0.0145
20	0.1610	40	0.0980	60	0.0400	80	0.0135

LETTER SIZE TWIST DRILLS

Letter Size	Diam. Inches	Letter Size	Diam. Inches	Letter Size	Diam. Inches	Letter Size	Diam. Inches
Z	0.413	S	0.348	L	0.290	E	0.250
Y	0.404	R	0.339	K	0.281	D	0.246
X	0.397	Q	0.332	J	0.277	C	0.242
W	0.386	P	0.323	I	0.272	B	0.238
V	0.377	O	0.316	H	0.266	A	0.234
U	0.368	N	0.302	G	0.261		
T	0.358	M	0.295	F	0.257		

GENERAL. Drills below ¼ inch in diameter are made with a straight shank, while larger drills are made either with a taper shank or straight shank, the taper usually being the standard Morse taper. With these drills a short neck is placed between the grooved portion and shank.

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TELEPHONE ENGINEER

COMPILED BY
J. B. RATHBUN

STANDARD SCREWS (BB-10-25)

Properties of Standard Screws

SMALL STANDARD MACHINE SCREWS. The following table gives the principal dimensions of the old system of small machine screws. This system is still much used in spite of the later standard adopted by the American Society of Mechanical Engineers for this class of work. The American Society Standards will be given later on.

OLD STANDARD MACHINE SCREWS AND THREADS

No. of Screw	Diam. Inches	Thds. per Inch	No. of Screw	Diam. Inches	Thds. per Inch	No. of Screw	Diam. Inches	Thds. per Inch
1	0.071	64	8	0.166	32	16	0.272	18
1½	0.081	56	9	0.180	30	18	0.298	18
2	0.089	56	10	0.194	24	20	0.325	16
3	0.101	48	11	0.206	24	22	0.350	16
4	0.113	36	12	0.221	24	24	0.378	16
5	0.125	36	13	0.234	22	26	0.404	16
6	0.141	32	14	0.246	20	28	0.430	14
7	0.154	32	15	0.261	20	30	0.456	14

A. S. M. E. STANDARD MACHINE SCREWS. This is the present standard small screw now in use. The thread is a U. S. Standard thread, or a 60° vee thread flattened at the top and filled in at the toor by one-eighth the height of the thread. This thread is supplemented by a series of A. S. M. E. Special Standard Screws which also have a U. S. Standard thread.

A. S. M. E. STANDARD MACHINE SCREWS
(U. S. THREAD FORM)

No.	O.D.-T.P.I. (Basic)	Outside Diam. Min.	Outside Diam. Max.	Pitch Diam. Min.	Pitch Diam. Max.	Root Diam. Min.	Root Diam. Max.
0	0.060-80	0.0572	0.0600	0.0505	0.0519	0.0410	0.0438
1	0.073-72	0.0700	0.0730	0.0625	0.0640	0.0520	0.0550
2	0.086-64	0.0828	0.0860	0.0742	0.0759	0.0624	0.0657
3	0.099-56	0.0955	0.0990	0.0857	0.0874	0.0721	0.0758
4	0.112-48	0.1082	0.1120	0.0966	0.0985	0.0808	0.0849
5	0.125-44	0.1210	0.1250	0.1082	0.1102	0.0910	0.0955
6	0.138-40	0.1338	0.1380	0.1197	0.1218	0.1007	0.1055
7	0.151-36	0.1466	0.1510	0.1308	0.1330	0.1097	0.1149
8	0.164-36	0.1596	0.1640	0.1438	0.1460	0.1227	0.1279
9	0.177-32	0.1723	0.1770	0.1544	0.1567	0.1307	0.1364
10	0.190-30	0.1852	0.1900	0.1660	0.1684	0.1407	0.1467
12	0.216-28	0.2111	0.2160	0.1903	0.1928	0.1633	0.1696
14	0.242-24	0.2368	0.2420	0.2123	0.2149	0.1807	0.1879
16	0.268-22	0.2626	0.2680	0.2358	0.2385	0.2013	0.2090
18	0.294-20	0.2884	0.2940	0.2587	0.2615	0.2208	0.2290
20	0.320-20	0.3144	0.3200	0.2847	0.2875	0.2468	0.2550
22	0.346-18	0.3402	0.3460	0.3070	0.3099	0.2649	0.2738
24	0.372-16	0.3660	0.3720	0.3274	0.3314	0.2810	0.2908
26	0.398-16	0.3920	0.3980	0.3544	0.3574	0.3070	0.3168
28	0.424-18	0.4178	0.4240	0.3745	0.3776	0.3204	0.3312
30	0.450-14	0.4438	0.4500	0.4005	0.4036	0.3464	0.3572

NOTE: In the above table, the maximum sizes are standard.

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TELEPHONE ENGINEER

COMPILED BY
J. B. RATHBUN

COLUMBIA DRY CELL
No. 6.
TRADE
MARK
This cell is intended for open circuit intermittent service, and has the highest efficiency and greatest recuperation of any dry cell manufactured.
IT IS DESIGNED AND MADE FOR THE USER THAT SEEKS THE BEST, BEING GOVERNED BY QUALITY NOT PRICE
MANUFACTURED BY
NATIONAL CARBON CO. Inc.
Long Island City, New York, U.S.A.
Patented September 6th, 1910

The intermittent nature of telephone use requires batteries to remain idle much more than they actually work. How they spend their spare time is therefore very important. Columbia Gray Label Batteries save their energy by quitting when the talk is over, by doing nothing at all to deplete their power while the receiver is on the hook.

It's the secret of why Columbias cost less per month of service. Fahnestock Spring Clip Binding Posts at no extra charge.

NATIONAL CARBON COMPANY, INC.
Long Island City, N. Y.

Atlanta Chicago Cleveland
Kansas City San Francisco

Canadian National Carbon Company, Limited, Toronto

Columbia
Telephone Batteries

"less cost per month of service"

NATIONAL

Double Tube SLEEVES

for overhead construction work

Easy to Work With—Protect From Corrosion

The increased popularity of "National" Double Tube Sleeves is testimony to the fact that these connectors have made good in every respect.

They have been accurately manufactured to size to fit the cable for which they are intended, carefully annealed and make a joint that is stronger than the wire itself.

C-B KNOBS

For working with drop wires these insulators are a vast improvement over the old-style rigid insulators. Because of their flexibility, they save in cost of wire, labor and time.

THE NATIONAL TELEPHONE SUPPLY COMPANY

5100 Superior Avenue, Cleveland, O.

CABLE RINGS

National Junior Cable Rings are easily installed. The tension is such as to create a greater hold on the messenger, the harder they are pulled. Ample space is provided for reclipping.

TELEPHONE APPARATUS (QQ-30-20)

The Telephone Receiver

ELEMENTS OF THE RECEIVER. There are three principal active elements in the usual form of telephone receiver: (1) The thin sheet iron diaphragm which vibrates in unison with the imposed voice currents and which converts these currents into sound waves, (2) The small electromagnets wound with many turns of very fine wire which act on the diaphragm and cause the oscillations, and (3) The permanent magnet which exerts a continuous and uniform pull on the diaphragm, causing the metal to be under a continuous stress under all conditions.

When the receiver is operating, the small voice current impulses in the coils of the electromagnets either increase or decrease the field of the permanent magnets depending upon the direction of current flow, thus attracting the diaphragm more or less strongly toward the magnets. In this way, the sound waves produced by the diaphragm correspond very closely to the current fluctuations both in regard to intensity and wave form. The diaphragm movement can never exactly correspond to the current waves, owing to its inertia and rigidity, but for almost all practical purposes the impulses and movement are in very close agreement.

The sensitivity of the receiver, or its response to very small weak currents is proportional to the pull exerted on the diaphragm, and this in turn is proportional to the square of the strength of the magnetic field. This fact at once suggests that some sound distortion must take place as the diaphragm movement is not directly proportional to the current fluctuations but to the square of the current fluctuations. This, together with certain other internal reactions, results in distortion at extremely high and low current frequencies as will be later described.

A brief elementary analysis will show the factors contributing to the sensitivity of the receiver or the amplitude of the diaphragm vibrations.

Let H = The constant magnetic field strength due to the permanent magnets, acting on the diaphragm.

h = The additional magnetic field strength (or opposition) due to the currents passing through the electromagnets.

F_e = Force or pull on diaphragm exerted by permanent magnetic field.

i = Received current flowing through coils.

K = Constant or proportional factor which varies with the design of the receiver, the materials used, etc.

As the pull is proportional to the square of the field strength, the constant pull exerted by the permanent magnets can be expressed by:

$$F_e = KH^2$$

When the received current (i) flows through the coils, the total pull on the diaphragm will be proportional to the square of the sums of the two magnetic fields (H) and (h) since both are acting simultaneously. The total force (F_t) becomes:

$$F_t = K(H + h)^2 = KH^2 + Kh^2 + 2KHh$$

The latter three terms of the expression show that the pull on the diaphragm can be resolved into three component pulls which have varying effects on the diaphragm.

TELEPHONE ENGINEER COMPILED BY
J. B. RATHBUN QQ-30-20
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If the subscriber paid direct

Suppose that every Monday morning all the people who have a hand in furnishing your telephone service came to your door for your share of their pay. From the telephone company itself, would come operators, supervisors, chief operators, wire chiefs, linemen, repairmen, inspectors, installers, cable splicers, test-boardmen, draftsmen, engineers, scientists, executives, bookkeepers, commercial representatives, stenographers, clerks, conduit men and many others, who daily serve your telephone requirements, unseen by you.

There would be tax collectors to take your share of national, state and municipal taxes, amounting to over forty million dollars. There would be men and women coming for a fair return on their money invested in telephone stocks and bonds—money which has made the service possible.

Then there are the people who produce the raw materials, the supplies and manufactured articles required for telephone service. They would include hundreds of thousands of workers in mines, smelters, steel mills, lumber camps, farms, wire mills, foundries, machine shops, rubber works, paint factories, cotton, silk and paper mills, rope works, glass works, tool works, and scores of other industries.

When you pay your telephone bill, the money is distributed by the company to the long line of people who have furnished something necessary for your service. The Bell System spares no effort to make your service the best and cheapest in the world, and every dollar it receives is utilized to that end.

"BELL SYSTEM"

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

AND ASSOCIATED COMPANIES

One Policy, One System, Universal Service, and all directed toward Better Service

The European Wire Systems

A Survey of Telephone and Telegraph Developments in Europe in 1922, by a Telephone Engineer Correspondent—Much Work Stopped by War, Under Way Again

By Bruno Shapira

There were more than 21 million telephone stations existing in the world in 1922, of which 67% belong to the U. S. of A. and 24% to Europe, the rest to the other parts of the world. In Europe there are 76 inhabitants per telephone station; in the U. S. of A., 8. In Europe, before 1914, the question between manual systems or automatic systems was not yet decided. Through the war human work had become so enormously expensive that the decision was in favor of the automatic system. The automatic system, which originally came from the U. S. of A., and which had its first practical use for a telephone exchange in 1898, could only be introduced into Germany 19 years later. Since that time it has been a success in every respect in all parts of Europe. The question between either Pupin cable or Krarup cable was decided in favor of Pupin cable, because in order to attain the same effect with Krarup cable considerably stronger copper wires are required. Nevertheless, the Krarup cable is of importance in certain cases and it has been used principally for submarine cables, where it is possible to increase the speed of telegraphing to 300 letters a minute. The total length of the submarine cables paid out till now is more than 300,000 miles.

Telegraph Progress in England

In England the typewriter has not yet been used for telegraphic service, the Creed apparatus putting the typewriter absolutely in the background. One of the well-known punchers the American vibroplex key has been refused; the perforators of Gell and Kleinschmidt have been variously judged by the offices, while the perforators of Wheatstone type are preferred to the manual system formerly customary.

Among the telegraph apparatus the Télétype apparatus is worthy of notice today. The Teleprinter apparatus, which works with a key perforator, requires compressed air at the receiving station for the reproduction of letters. The Start-stop apparatus of the Western Electric Co. is said to cost a great deal for its maintenance. Comparing proofs made with Baudot apparatus, which were worked once with automatic system and once with manual system, showed that the automatic system is 25% ahead of the manual system. The enlargement of the Baudot multiplex connection is being supported by the British telegraph administration. On the line Birmingham-Portsmouth proofs are being made at present with six times duplex connection. The line Liverpool-London-Paris-Lyons with three times duplex connection is being examined and seems to be satisfactory if the interruptions which sometimes occur on such long lines are considered. For sending the letters the post-standard relays are used in London. During the conference in Cannes the Baudot multiplex connection was enlarged. Two conductors of the line Paris-Cannes were connected by automatic apparatuses in Paris with two conductors of the three times duplex connection London-Paris and by these means a straight connection was established between London and Cannes. When later on the telegrams of the government and the journalists increased, two conductors were added and were conducted into duplex via London-Paris. Although the English telegraph administration decided for the multiplex apparatuses, the high-speed telegraph of Siemens and the Creed system are in favor. The system just mentioned has special advantages, principally for journalism telegrams.

The pneumatic arrangements made for manual service are to be changed into automatic service. In the apparatus offices belt conveyors are in use. The experiments with the cableway by Lamson "S" system in Birmingham have been stopped.

At the present time 14 cables are doing the North American service, two of which belong to England, the others to America. One of the two cables belonging to the British telegraph administration is let to the Western Union Telegraph Co. The cable London-Halifax (formerly Emden-Azores-New York) does 220,000-240,000 words a week and does the service with Canada, West India and via Halifax-Vancouver, the land-line, and the Pacific cable, with Australia.

The principal insulating material for submarine cables is guttapercha, rarely Balata. Nearly all longer submarine cables are worked with the bridge-duplex connection. The siphon recorder is still in use as receiver, the working speed is increased by employing amplifiers. These are mostly made after the style of the moving coil galvanometer, like the recorder.

Long Distance Cable Plant Is Building

The telephone trunk cable London to Manchester has been started. It is 183 miles long, contains 160 pairs of conductors, is fitted out with amplifier plants, by which it was possible to reduce the weight of the copper to 40 lbs. a mile. Meanwhile an amplifier plant has been put up in Leicester, later on amplifiers are to be used at Derby and Fenny Stradford so that it may be possible to get good connections with Liverpool, Leeds and other towns situated to the north. As a number of overhead lines have been demolished last year by storms, the telegraph administration has given orders for trunk cables of a total length of 800 miles.

Beginning in August a new trunk cable from England to Holland has been under construction. It contains four wires, the copper of which weighs 160 lbs. and the guttapercha covering 150 lbs. per mile. The length of the cable is 80 miles, so that it is one of the longest submarine telephone cables. The cable which was laid recently from Germany to Sweden is 80 miles long, the German cable to East Prussia 100 miles long. The new cable is a Pupin cable, the Pupin coils of which are arranged in spaces of one mile. Already, before the war, the connecting land lines in England were nearly ready, whereas the submarine cable was still being made. On account of the military operations during the war it was impossible to pay it out in the North Sea, therefore the cable was used for increasing the connections with France, and after the war a new cable was paid out to Holland. Till now only two cable conductors have been in use, which connect London with Amsterdam, Rotterdam and the Hague.

No Delay Service Is Being Extended in London

Until now only the subscribers of the telephone exchanges in the centre of London were able to have a no-delay call with one another. The calls

INTERNATIONAL DATING NAILS

Permanently Identify International Creosoted Pine Poles

EVERY International Pole, before it leaves our plant, bears the stamp of approval of this company in the form of the I. C. C. Co. dating nail. This nail, located about 10 feet from the butt of the pole has our monogram and the date the pole leaves our plant. We are doing this because we are proud of the quality of our poles and the remarkable records they are making in different localities and in all classes of service.

This nail demonstrates our willingness to stand behind our products and assures the purchaser that he is receiving only the best. It serves as an identification for all time.

In future years we want you to identify the poles which are rendering exceptionally fine service. The I. C. C. Co. dating nail will tell the story because International Poles are strong, they are carefully supervised through every phase of manufacture and thoroughly treated to give the desired long life.

Send us your requirements—We will quote prices and delivery.

International Creosoting & Construction Co.
General Office—Galveston, Texas

Plants: Texarkana, Texas Beaumont, Texas
Galveston, Texas

of the subscribers belonging to the provincial telephone exchange with one another and with the subscribers of the London telephone exchange were conducted over the trunk line exchange, or rather over several central telephone exchanges. In any case they were treated like long distance calls. The new toll exchange having been arranged, the long distance service of London is regulated in a new style. The toll exchange is connected with all the provincial exchanges within a circumference of 25 miles and with all the London exchanges by direct cable lines. All calls from one provincial exchange to another provincial exchange or from a provincial exchange to a London exchange within the mentioned circumference will be connected in future by the toll exchange and treated as no-delay calls. The toll exchange has 93 operators' positions. The 600 lines coming from the London exchange end in the positions 4-64 (control positions), the lines coming from the provincial exchanges end in the positions 65-93. The positions 1-3 are meant for the trunk service of the provincial exchanges, which, as already mentioned, will be conducted over the toll exchange.

The trunk exchange which was opened in Norwich Street, London, is supposed to take up 35% of the trunk service, which amounts to about 12 million calls a year.

Printing Telegraph Development in France

The Companie Mercur has constructed a printing apparatus for long distance called Télétype, which has already been mentioned. This is a simplified Baudot apparatus which has a keyboard instead of a keychain and which can be handled without having studied it before. By pressing down a key five bars are set moving in a certain arrangement which sends current impulses into the line like the Baudot. At the receiving station the current impulses operate an electro-magnet, which in attracting its armature works mechanically on five rejectors, and, according to the printed letters, puts them into working position. The rejectors do the same work as the angle levers in the Baudot. The print of the latter is done in the well known fashion. In order to maintain synchronism, a current impulse is sent into the line before every letter. Two mechanical devices disconnect the axis of the type-wheel from the motor-axis, so that the type-wheel is stopped a moment before each letter. This device is supposed to guarantee a very exact adjustment.

In order to start movement phonic wheels were lately put into the Baudot distributors and were driven by direct current of 220 volts with the help of tuning forks. This synchronism regulation is easily worked and the principal advantage is that it is quite immune to changes of the voltage which at times varied from 180-240 volts. The cause of this insensibility is that a tuning fork driven by electro-magnetism shows even in doubling the excitation current variations in the number of vibrations of but 0.9%.

In order to raise the operating speed of the 2,800-mile submarine cable from Brest to Darkar from 90-95 letters to 120-125 letters a minute, the service voltage of 30 volts was reduced to 20 volts and a magnetic shunt was put in at the receiving station (self-induction and Ohmic resistance). By doing this the letter became unreadable and it was necessary to make them readable again by five tube amplifiers.

German Telegraph Net Is Being Improved

The new combined telegraph and telephone cable from Germany to Sweden, which has already been mentioned, was constructed in two parts. Both parts were transported in special trains to the starting station, Nordenham, and were joined on board the cable steamer. The paying-out was done at a speed of 4½-6 miles an hour, and the entire work was finished in 24 hours.

In order to increase its capacity the German telegraph net is to be reorganized by replacing the long overhead lines by cables, leaving out the Hughes apparatus. The Siemens high-speed telegraph is to be used for the long-distance service and for ordinary service, and for duplex connections sounders are to be used. The Morse closed circuit connections are to be replaced by telephones.

At present the highest speed of 1,000 turns a minute may be attained by the Siemens high-speed telegraph. In practical service they work with a maximum of 600 letters a minute. At the present time several technical alterations are under development for the purpose of improving the perforators, diminishing the breadth of the strips of paper, and punching the guide holes in the strips of paper at the same time as the letters.

Long Distance Cable Supersedes Aerial Lines

The insufficiency of the overhead telephone lines regarding reliability of service was the cause for the German telegraph administration's paying out a telephone cable on the line from Berlin to Hannover. This cable was started at the end of the year 1914. During the war there was no possibility of extending this cable to Rhineland, but in 1920 the construction of the line from Hannover to Dortmund could be started. Instead of the type of cable used in the earlier sections, a cable with a large number of conductors made of 3 mm and 2mm wires was employed. This cable is known as the Rhineland cable. It is constructed as a Pupin cable and is laid in cement ducts. On the part of the line from Berlin to Magdeburg 24 double lines with diameters of 3 mm and 28 double lines with diameters of 2 mm were used. On the line from Hannover to Dortmund, 64 double lines were made use of, and besides a special inlaid cable with 7 double lines was put in. On the line from Dortmund to Cologne and from Dortmund to Duesseldorf the inlaid cable has been retained and the number of double lines has been increased to 138. In the meantime development of tube amplifiers in telephone service made it possible to diminish the diameters of the lines from 3 mm and 2mm to 1.4 mm and 0.9 mm. Both the lines from Dortmund to Duesseldorf and from Dortmund to Cologne had to be constructed with the large conductors, but both cables have a larger number of double lines of 1.4 and 0.9 mm in addition. In further extensions of the telephone cable net, only cables with small conductors will be used.

Automatic Operation Increasing

At present there are 53 automatic telephone exchanges with 80,000 telephone stations in Germany. Among these there are large exchanges in Munich, Dresden, Halle, Leipzig, Liegnitz and Freiburg. In Stuttgart, Zehlendorf, Halberstadt and Dessau work is being done on the exchanges. The plans for alterations for a number of other towns are finished. The telegraph administration has the greatest interest in increasing the automatic exchanges for economy's sake in itself, as this system is much less expensive than the manual system, even if the erecting expenses are greater. The conversion to the automatic system can only be done by degrees as finishing an exchange with 10,000 subscribers takes more than a year.

Replacing rotted telegraph poles, which used to be the custom, is not economical and is also the cause of interruptions on the lines, as the wires have to be taken down. Recently the bottom end of a standard-mast was found practical which is made of hard wood and is well soaked with tar-oil. It is joined to the upper part of the pole that is still intact by means of pieces of iron made for the purpose. Without taking down the lines this is done by holding the pole which is to be replaced with the help of a three-legged jack, sawing off the rotten part,

Everything for Your Outside Plant Is as Near You as Our Nearest House

To serve the operators of telephone outside plants, this Company distributes everything to construct and maintain such plants.

The manufacturers of these materials are nationally known; their products used wherever lines are built for a generation of service.

To save the time of these operators and the money it represents this Company maintains 48 Distributing Houses at railroad centers; locations making this material available at short notice.

The House near you can serve you with speed and the economy such methods obviously offer.

An Example

Western Electric distributes the Iron and Steel Wire and Strand made by the Indiana Steel and Wire Company. The quality of this product is indicated by its large and steadily increasing use.

A National Electric Service

Western Electric Company

OFFICES IN ALL PRINCIPAL CITIES

digging it out and replacing it by the bottom end of the mast.

The telegraph poles, which, after the style of Kyan, have been soaked with mercury sublimate of ⅔%, have a permanence of 16½ years. After a method which the German post administration has recently employed and improved a 1% sodium fluoric is added to the sublimate solution. This is much better than the sublimate and is particularly suitable, as it enters into the wood to twice the depth of the mercury sublimate alone. Due to the increased antiseptic strength of the mixture the poles attain a greater durability so that the average permanence is supposed to be raised to 18½ years.

In order to protect telegraph lines which are laid parallel to high tension lines C. Lorenz uses recently a protecting connection which is constructed after the method of the Wheatstone bridge. In each branch of the bridge there are capacities, inductances and resistances as follows: In two branches opposite each other there are only Ohmic resistances, in each of the other branches one inductance and one capacity. The diagonal contains the apparatus with key and battery which is to be protected.

The draining of excess voltages which may occur in telegraph and telephone lines has been done recently with apparatus which has been in use heretofore in other ways. This device is a tube with three electrodes, two of which are connected with the lines, the third with the ground and filled with rare gases, such as Neon-Helium mixtures. Direct voltages of 90 to 95 and alternating voltages of 90 to 100 volts cause the appearance of discharge with an arc.

Telephone Installation in Italy Resumed

Work started in Italy in 1915 by Siemens to construct automatic telephone exchanges in Rome and Genoa and which was interrupted when the war with Italy and Germany broke out is now being continued. Besides this Siemens is building four automatic exchanges for Milano for 20,000 subscribers total.

For the conference in Genoa special connections to Germany were made. One telephone line from Genoa to Frankfort and Berlin, with amplifiers in Brieg and Freiburg, was used. The calls were good, and it was possible to convey the greater part of the journalistic reports over it. The daily output was about 180 calls. A Hughes connection from Genoa to Berlin was provided for the official service of the German delegation. A high-speed telegraph connection from Genoa to Berlin was also established. At first, Italy proposed a service with quadruplex-Baudot apparatus. Because of the length of the line this did not seem very practical. As duplex Baudot apparatus for duplex service did not exist in Italy, high-speed telegraphs by Siemens were used. The connection went from Berlin to Nuremberg with two cables and then via Zurich to Genoa in a line for duplex service. This service was so satisfactory that a part of the English journalists ordered the line via Berlin for their reports. The English news were taken up in Berlin by mechanical driven perforators and were forwarded to London by the high-speed telegraph line.

Government Taking Over Lines in Spain

In the course of five years the telegraph administration of the government will take Spain's telephone nets which have been till now in private hands. The contracts which were made for 40 years in average will expire within this time. The government is already taking possession of the lines in Barcelona.

New Trunk Office in Holland

The trunk exchange in Amsterdam has been enlarged by a second office, which was delivered by the Bell Telephone Manufacturing Co. The trunk calls are announced at a record station with 16 operators' positions. The call lamps are connected in multiple, with a special pilot lamp giving notice to the first non-occupied record operator that she has to answer the call. The call tickets are sent to the pneumatic distribution by a belt conveyor and are conveyed from there to the positions on the trunk line boards. Each operator's position is able to handle five trunk lines. When the service is small the lines are collected. The trunk lines between the trunk positions are connected so that by putting a plug into the multiple jack of a trunk line the inquiry system of the desired trunk line operation is connected automatically with the trunk line. If the operator is occupied a buzzer signal is put on to the trunk line. The two trunk offices contain 16 recording positions, 8 high-speed positions, 83 ordinary positions, 2 exchange positions, 8 collecting positions and 4 information positions. The enlargement was delayed by the war. A third office will probably be added.

Long Distance Cables in Sweden

In Sweden an extended telephone cable net between Stockholm and Gothenburg is being constructed. Of the cables installed in any part of the world the only one exceeding its length is the cable situated between Boston and Washington. For its construction 87,500 miles of wire, 25,000 coils and 8 amplifier plants are required.

Russia to Develop Telephones —IF— It Can Raise Money

Moscow, Russia.—National Commission of Posts and Telephones proposes to amalgamate all telephone systems under a single administration, and put into work a 20,000,000 gold ruble development program. Now it is impossible to utilize telephone service in Russia with any degree of satisfaction. Pre-revolutionary service was defective technically. In January, 1916, there were 660 telephone networks in Russia; of these 178 belonged to the State, 124 were held under concessions, and 149 were private, the total number of subscribers being 335,347. But owing to the war and the revolution, the number of telephone apparatus (subscribers) on January 1st, 1922, only amounted to 113,000, whereas if the pre-war rate of development had continued there would have been 600,000 by the beginning of last year. Beginning with 1919, the whole of the telephone system was nationalized as an indivisible whole and handed over to the National Post Office Department, which was left to administer the service. Out of 305 existing networks in towns, only 11 per cent have underground cables, and 67 per cent of the 89 overhead networks are equipped with single-wire lines.

Switzerland Center of International European System?

London, Eng.—R. A. Dalzell, Director of Telegraphs and Telephones, will head the British delegation to the French conference for discussing the organization of an international European telephone system. Switzerland probably will be the center of the system.

Czecho-Slovakia Busy Last Year Building Its Lines

Prague, Czecho-Slovakia.—Eighty-seven new interurban telephone systems and 71 local systems were constructed last year by the Czecho-Slovak postal authorities. Fourteen of the local systems were reconstructed. This year's program calls for 39 interurban lines, including one between Prague and Paris.

Something for Borneo to Go Wild About

Washington, D. C.—If the famous "Wild Man of Borneo" could return to the scenes of his celebrated exploits, he would be wild, indeed, to find that automatic telephones are likely to be installed in his former lairs. The city of Jesselton, Borneo, according to a cable from Trade Commissioner Fowler to the Department of Commerce, is seriously considering automatic telephone installation.

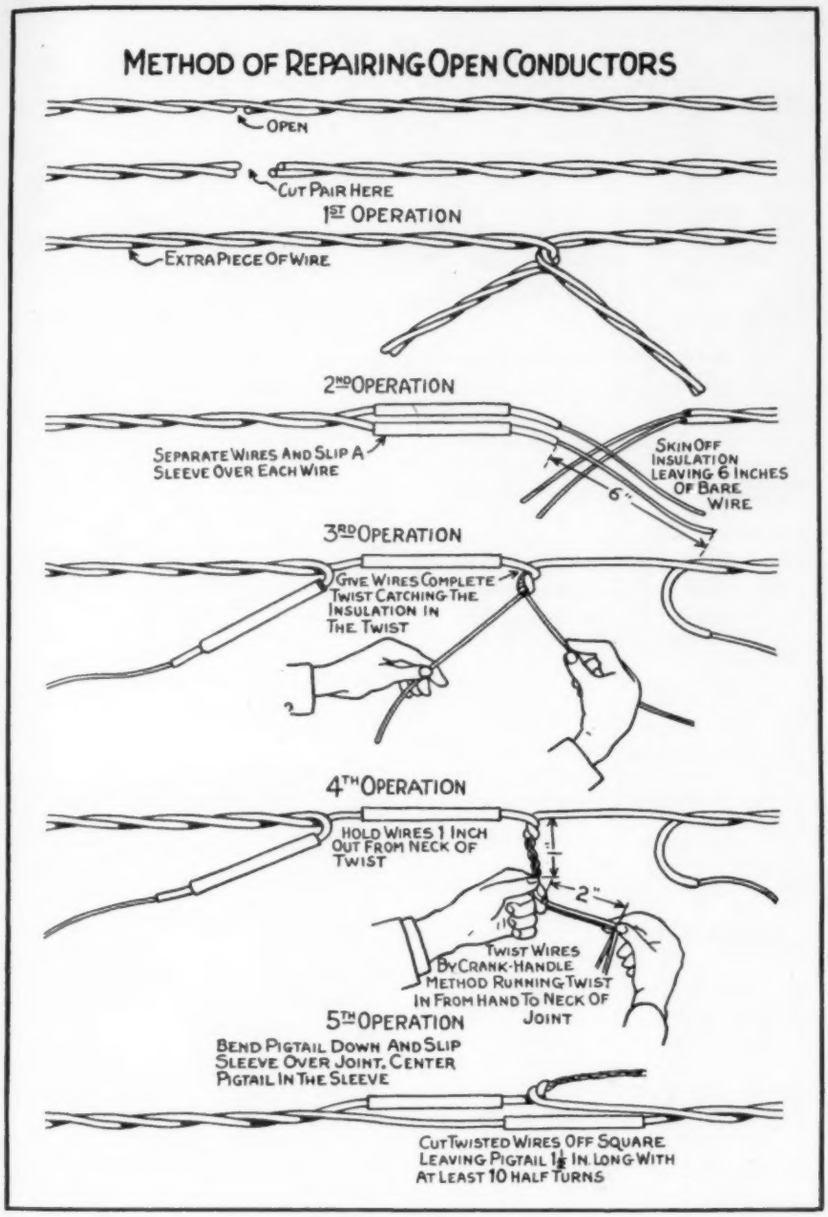

METHOD OF REPAIRING OPEN CONDUCTORS
OPEN
CUT PAIR HERE
1ST OPERATION
EXTRA PIECE OF WIRE
2ND OPERATION
SEPARATE WIRES AND SLIP A SLEEVE OVER EACH WIRE
SKIN OFF INSULATION LEAVING 6 INCHES OF BARE WIRE
6"
3RD OPERATION
GIVE WIRES COMPLETE TWIST CATCHING THE INSULATION IN THE TWIST
4TH OPERATION
HOLD WIRES 1 INCH OUT FROM NECK OF TWIST
1"
2"
TWIST WIRES BY CRANK-HANDLE METHOD RUNNING TWIST IN FROM HAND TO NECK OF JOINT
5TH OPERATION
BEND PIGTAIL DOWN AND SLIP SLEEVE OVER JOINT. CENTER PIGTAIL IN THE SLEEVE
CUT TWISTED WIRES OFF SQUARE LEAVING PIGTAIL 1½ IN. LONG WITH AT LEAST 10 HALF TURNS

FIG. 3

(Continued from page 16)

Caution—Avoid Overheating of Paraffine

As soon as the paraffine appears to have reached the proper temperature, remove the pot from the furnace and test the paraffine to see that it is NOT TOO HOT. Whenever a white smoke rises from the surface of the paraffine, it is too hot to use, and must be removed quickly to a distance from the furnace and allowed to cool. SUPERHEATED PARAFFINE IS DANGEROUS, as it will sometimes ignite from exposure to the air even when not near a flame. It will also, if used, ruin the **insulation** on the cable.

Paraffine may be re-used several times, adding small pieces of paraffine to the pot as required. When the paraffine becomes dirty, do not attempt to use it any further, but pour it off, clean the pot, and supply fresh paraffine. Paraffine if used when extremely discolored will stain the paper insulation on the wires, and make it difficult to distinguish the colors.

Boiling Out Muslin, Sleeving, Etc.

When it is necessary to boil out cotton tape, muslin or cotton sleeving, heat the paraffine as directed above and **remove** the pot from the furnace **before** introducing the article to be boiled. The pot should never be allowed to remain on the furnace when boiling out any splicing materials.

Boiling Out the Cable

The paraffine can best be poured from a dipper held a short distance above the wires, while at the same time the pot is held below to catch the drippings. DO NOT START boiling out at the CENTER OF THE OPENING. START the boiling process by pouring the paraffine at a point FOUR (4) INCHES BACK on the **sheath** and continue until the sheath is thoroughly heated. Repeat this process at the other end of the opening, after which move the operation gradually along the wires, alternately from both ends, thus driving the moisture toward the center of the opening.

Don't Drive Moisture Under Sheath

Moisture must not be driven back into the cable and care must be taken to guard against it, by applying the hot paraffine first to the cable sheath at the ends of the opening. If bubbles form at the end of the sheath at the first application of hot paraffine it is an indication that not enough sheath has been removed to get past the moisture. In this case remove another foot of sheath and bind up the end of the opening with muslin as before directed, after which with the paraffine at proper temperature, pouring should again be started. The pouring should be continued as long as bubbles are given off, or a cracking or frying sound is produced.

Protection of Opening

First compress the wires together lightly and wrap the opening from end to end with two layers of freshly boiled out muslin, extending the wrapping 3 inches over the sheath at each end of the opening. The two layers of muslin should be wrapped in reverse directions without cutting at the end of the first layer. The muslin should not be wrapped any tighter than is necessary to produce a smooth surface. Tie the muslin at the end, as shown in Fig. 4-A. The wrapping should then be boiled out by pouring hot paraffine first on the lead sheath at each end, and then working gradually toward the center of the wrapping.

The opening should then be wrapped with four layers of 2-inch adhesive tape, extending 3 inches farther back on the sheath at each end than covered by the muslin. The two outside layers of tape should be placed in two pieces, beginning at the ends and working toward the center so as to lap in the manner of shingles. See Fig. 4-B.

The cable should then be raised and the center of the taped portion tied to the messenger with at least four turns of marlin, as shown in Fig. 4-C.

Permanent Repairs to Sheath

After the trouble has been located and cleared and the opening in the sheath protected as described above, the cable will be in condition to give service for a few weeks, if necessary. As soon as possible, however, an experienced cable splicer or a plumber,

who can work in the location where the trouble was found, should be secured to replace the lead sheath and complete the repairs in a permanent manner.

When a plumber is employed, care should be taken to see that the temporary protection is removed; that the repaired section is again boiled out with paraffine, following closely the instructions referred to in that section, after which two or more layers of boiled muslin should be applied over the conductors in the open section, after which a lead sleeve just large enough to comfortably slide over the wrapped portion should be applied and wiped joints made at both ends. Obviously it will be necessary to slit the sleeve in order to apply it. The plumber or experienced cable splicer will have no real difficulty in doing the lead work in a satisfactory manner, and a section of cable thus repaired will resist trouble in the future.

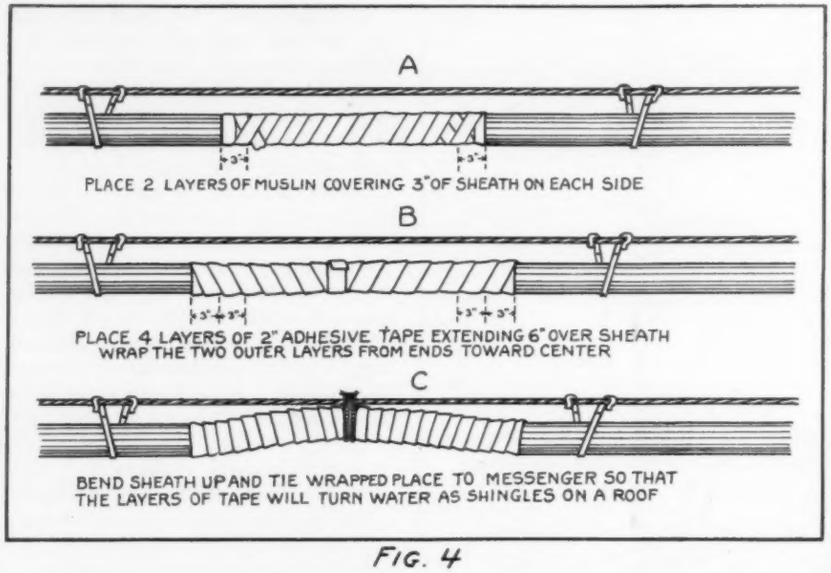

A
3"
3"
PLACE 2 LAYERS OF MUSLIN COVERING 3" OF SHEATH ON EACH SIDE
B
3" + 3"
3" + 3"
PLACE 4 LAYERS OF 2" ADHESIVE TAPE EXTENDING 6" OVER SHEATH
WRAP THE TWO OUTER LAYERS FROM ENDS TOWARD CENTER
C
BEND SHEATH UP AND TIE WRAPPED PLACE TO MESSENGER SO THAT
THE LAYERS OF TAPE WILL TURN WATER AS SHINGLES ON A ROOF

FIG. 4

BELL AFTER KANSAS CITY?

Southwestern-Gary Negotiations Now "Newspaper Talk"—Manufacturing Not Affected

Kansas City, Mo.—Purchase of a stock control in the Kansas City Telephone Co. from the Gary interests by the Southwestern Bell, is the subject of negotiations, according to Kansas City reports which Theodore Gary, president of Gary and Co., characterizes as "just newspaper talk."

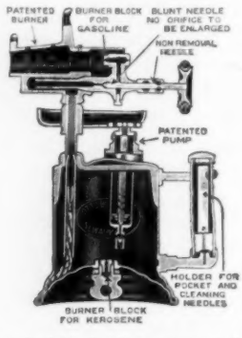
Long distance properties of the Gary interests in Kansas, Missouri and Texas, and local exchanges in Illinois, do not figure in the deal, according to present reports.

Kansas City is a strategic and tempting point for the Bell and the Gary operation has put the present company in so solid with the public in general that the element of public approval of the proposed sale, figures prominently. Deals which are interpreted as being preliminary to the Gary-Southwestern affair, now are awaiting the sanction of Missouri and Kansas public utility commissions.

The Gary interests, whatever may be the development of the Kansas City Telephone Co. deal, will continue to own and operate their long distance business in the Missouri, Kansas and the southwest, and will vigorously continue with the expansion of their telephone manufacturing interests in the United States and abroad.

Bernz Brings Out New Torch with Four Improvements

Newark, N. J.—Otto Bernz Co. has added to its line of combination gasoline-kerosene blow torches a No. 79 torch. The company, in telling of the


PATENTED BURNER
BURNER BLOCK FOR GASOLINE
BLUNT NEEDLE NO ORIFICE TO BE ENLARGED
NON REMOVAL NEEDLE
PATENTED PUMP
HOLDER FOR POCKET AND CLEANING NEEDLES
BURNER BLOCK FOR KEROSENE

features of this device, states: "(1) The burner needle is absolutely blunt and fits into an open channel. Due to this construction, there is no orifice to be enlarged, which is the common fault with ordinary torches. (2) The burner needle is so constructed that it cannot be removed unless the entire stuffing box nut is unscrewed, making a safer article. (3) The gasoline burner block is screwed into the burner ready for use. The kerosene burner block is screwed into the filler plug. When kerosene is used as a fuel it is merely necessary to reverse the burner blocks. In this manner the burner blocks are always handy when required. For the convenience of the user the gasoline burner block is marked 'G,' and the kerosene burner block is marked 'K.' (4) With these torches there is furnished one patented pocket folding cleaning needle and two extra cleaning needles. These are placed into the handle of the torch so that they are handy when required by the user."

E. W. Rockafellow Made Vice-President of National Pole Company

New York, N. Y.—May 1st, E. W. Rockafellow, general supply sales manager of the Western Electric Co., became a vice president of the National Pole Co., of Escanaba, Mich., and will

E. W. Rockafellow

represent them at 220 Broadway, New York. Mr. Rockafellow entered the employ of the Western Electric Co. as an office boy. He studied shorthand and was H. B. Thayers' secretary. In 1890 Mr. Rockafellow was made assistant purchasing agent, and when the company opened a store in Thames Street, New York, in 1892, he was placed in charge.

In 1894 Mr. Rockafellow was appointed traveling salesman. After the Spanish war, he was appointed sales manager of the Western Electric Co.'s New York house, becoming supply sales manager in 1908, and general supply sales manager in 1919.

CABLES

FOR SWITCHBOARD
AND
INTER-PHONE WORK

Cables are made of tinned copper or enameled copper wire, insulated with the highest grade of Tussah Silk and long staple cotton.
Core—Our standard practice is to furnish cables with saturated wax core. This has proven far superior to the so-called dry core cable. We can, however, supply the dry core cables.
Switchboard and Inter-Phone Cables can be furnished in both Braided and Leaded types.

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Manufacturers of
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Cables and Wires

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Smooth finish
Easy to pull in
Safe and Satisfactory
Quick delivery

SIMPLEX WIRE & CABLE Co

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CHICAGO SAN FRANCISCO

MANUFACTURERS OF

9 Duct

VITRIFIED, GLAZED, CLAY CONDUIT

We carry large stocks of round singles, square single, two, three, four, six and nine duct, in standard and short lengths, splits, mitres and bends.

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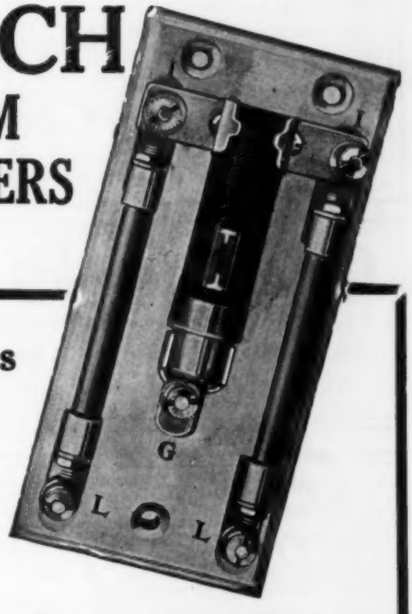
GUARANTEED

THE CLAY PRODUCTS CO.
BRAZIL, INDIANA

BRACH
VACUUM ARRESTERS



at prices within your reach

When the best protection costs no more, why not have it? BRACH arresters insure; non-grounding of lines, cables, clear transmission, balance of potential between pairs, and full protection against power crosses or lightning. There are no carbons to clean and no maintenance bills.

You can readily afford BRACH Vacuum Arresters at our present low prices. Type 440, shown above, complete with porcelain base, fuses and mountings, sells at $1.50 each.

L. S. BRACH MFG. CO.
NEWARK, N. J.

Springfield, Ill.—A reprint of the Illinois Telephone Assn.'s statement to the Interstate Commerce Commission on Depreciation Charges of Telephone Companies has been made by the association.

Rochester, N. Y.—The paper dealing with a school for plant employees, read by Robert M. Bruce, plant superintendent of Rochester Telephone Corp., has been printed in full by the Up-State Telephone Association, before which the paper was read.

Welwyn Rural Telephone Co., Welwyn, Sask., Can., will do general repair work this season and is in the market for all necessary supplies. H. Black is the company's agent.

New York, N. Y.—In March New York won the honor of being the first city in the world to have a million telephones.

Cook Electric Unites Factories in Big New Plant

Chicago, Ill.—Chicago and Zion City, Ill., factories of the Cook Electric Co., have been brought together under one roof—that of the big plant at 2700 Southport Ave., Chicago. The company's general offices also now are at that address. As a result of several months' planning the factory moves were made without any interruption to the production. The new Cook factory is a one story brick building with saw-tooth roof and is a day-light workshop demonstrating the best modern practice in factory design and operation.

Indianapolis, Ind.—Ruling in the consolidated rate case involving every Bell exchange in Indiana probably will be made by the Indiana commission about July 1.

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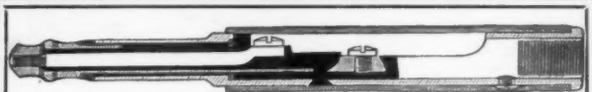
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